

80~~W~~LS

The Basic Computing Journal for the TRS-80

Vol. VI, No. 6 \$3 per copy June, 1983

19 Color Computer Game Reviews

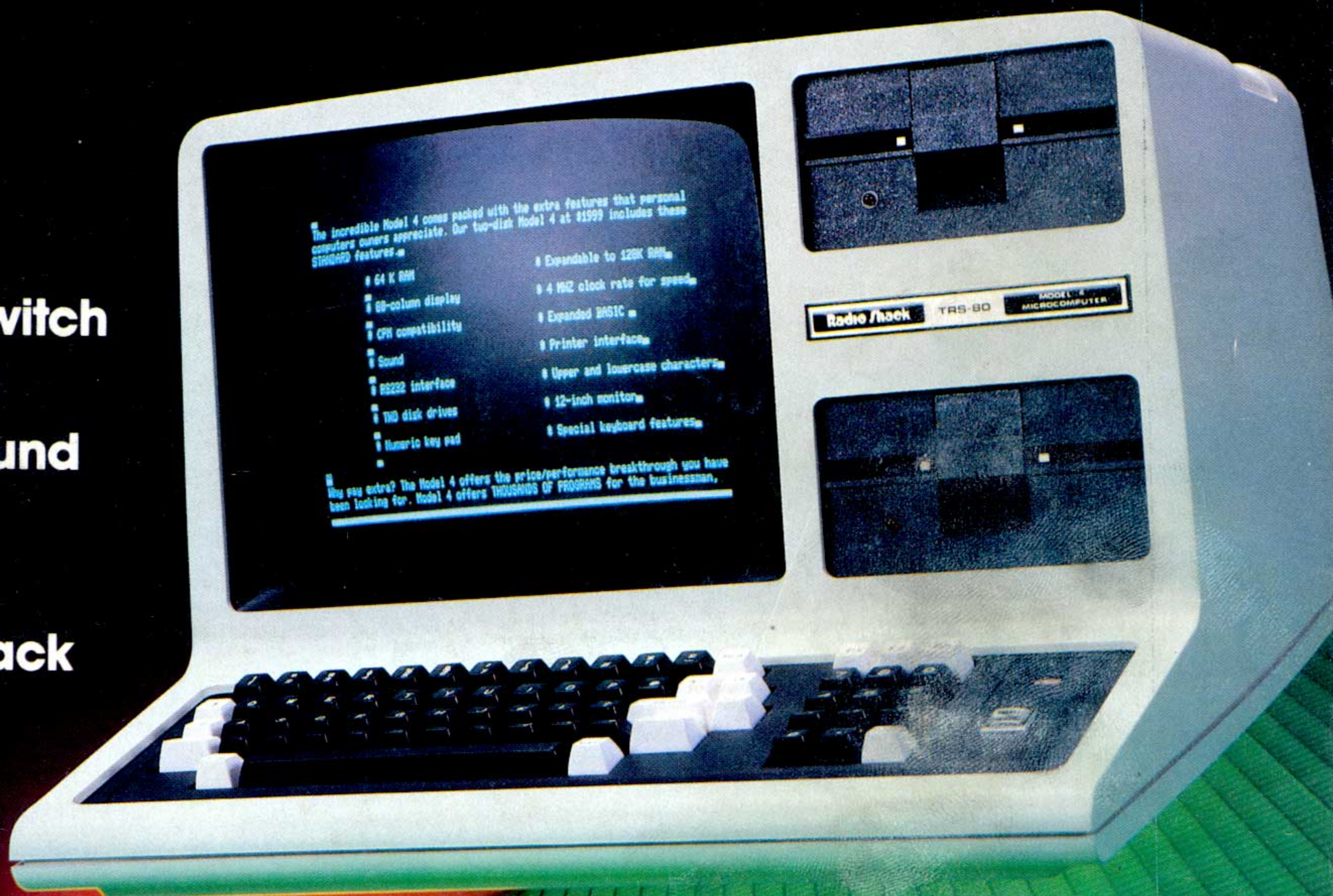
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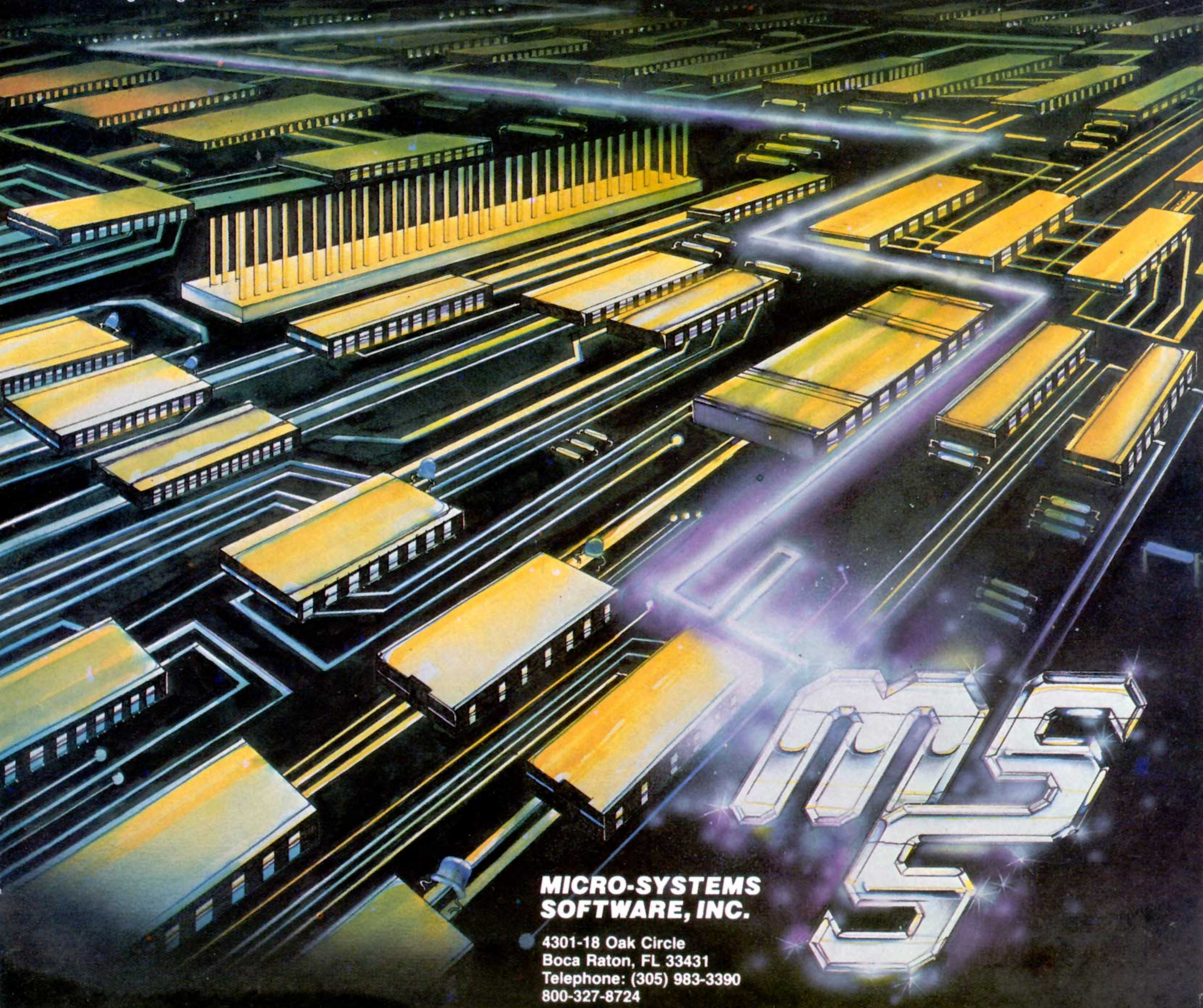
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The Model 4 is the fourth new computer to be announced by Radio Shack this year. Photo courtesy of Radio Shack, a division of Tandy Corp., Fort Worth, Texas.

80-U.S.

The Basic Computing Journal for the TRS-80

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2. I can save you 100's of hours of time. I provide real short cuts to meet your needs by going direct from your idea to a ready to use, customized program. I write all the BASIC code for you. I'm simple, but I'm not shallow. The only limit to my capacity is your imagination.

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5. I can help make you a real pro. Based on your ideas, I write complete stand alone programs. I write in BASIC code, but you talk in English to me. And if you're an entrepreneur, you can sell the programs you and I create. As a licensed owner of THE PRODUCER, you may do so without paying royalties.

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TECHNICAL COMPARISON CHART

	PRODUCER	JR.	QUICKPRO	CREATOR
FEATURES OF THE FINISHED BASIC PROGRAM				
Full Screen Oriented Input of All Fields	YES	YES	NO	NO
Edit without Retyping with insert & delete	YES	YES	NO	NO
Restrict field Length automatically	YES	YES	YES	NO
Unlimited Restriction choice for each field	YES	YES	NO	NO
User defined Custom Prompts for each Field	YES	YES	NO	NO
Full Speed Typing in ALL Fields	YES	YES	NO	YES
Immediate Exit from ANY Field to Menu	YES	YES	NO	YES
Enter Fields from last Record automatically	YES	YES	NO	NO
Fast B-TREE File Structure (No Sort Needed)	YES	YES	NO	NO
Hi-Speed Global Search for ANY Field in a Record	YES	YES	NO	NO
Duplicate Keys and Multiple Keys Supported	YES	YES	NO	NO
Global Field Replacement Function	YES	YES	limited	NO
Run Predefined Reports from Finished Program	YES	YES	NO	NO
Select Reports from Menu in Finished Program	YES	YES	NO	NO
Sort (machine language) ANY Field-Free	YES	NO	NO	NO
Custom Mailing Labels Option (any Size)	YES	NO	NO	NO
Do Calculations on fields in Program	YES	YES	YES	NO
Self Finished Program with No Royalty	YES	YES	NO	NO
PRODUCER CAPABILITIES & FEATURES				
Toll Free Question Line	YES	YES	NO	NO
Create PROFESSIONAL Finished Program	YES	YES	NO	NO
Modify Program without Starting Over	YES	YES	NO	NO
Ease of Use, including Complete TUTORIAL	YES	NO	NO	NO
Number of Calculations allowed per field	8	8	1	0
Use Field Names for Calculations	YES	NO	NO	NO
Use ALL Math Functions in Calculations	YES	NO	NO	NO
Generates a BASIC Program	YES	YES	YES	YES
Custom Design exact Screen YOU desire	YES	YES	NO	NO
Full Feature Screen Generator (graphics)	YES	NO	NO	NO
Easy Report Generation with Any Restrictions	YES	NO	NO	NO
Complete & Thorough DOCUMENTATION	YES	YES	limited	NO
Detailed Quick Reference Materials	YES	YES	NO	NO
Audio Cassette Tutorial Available	YES	NO	NO	NO
Program Planning Form Provided	YES	NO	NO	NO
Sample Programs Available before Purchase	YES	YES	NO	NO
FREE UTILITIES INCLUDED				
Free Menu Driven DOS Utility Package	YES	YES	NO	NO
Free Disk Operating System (Super Fast)	YES	YES	NO	NO
File Rebuilder & Reorganizer included Free	YES	NO	NO	NO

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Personnel Program	\$39.95	Organizes magazine articles/clippings	
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For an independent product review of the PRODUCER see page 62 of March issue of 80 Micro.

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80-U.S. Journal

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Editorial

Cameron C. Brown, Editor

We try to tell you the truth, but sometimes we pass along what has been called an "inoperative" statement.

Let me explain. We are working on one of our fall themes. I found some information in our files and got in contact with a company that said they had a new product which would be appropriate for that issue. We were promised a review copy. It never arrived. We kept calling. We still haven't seen it. We can't tell you if it works. They say so but we haven't seen it.

I hope not, but the product may not exist and this may not be an isolated case. New product announcements appearing in our "For immediate release" section are just that, announcements. They are not promises that the product works, works well, or is even in production. Now, before too many companies start writing letters, let me say that in most cases, the announcement is true and accurate. The problem is, you can't tell.

No magazine has the staff to check each announcement and the history of every company. In an industry that is so young, many of the advertisers you see are basement operations. That is not to be feared. I enjoy being able to talk directly to the president of a company, even if it only has two employees, rather than a fourteenth-level middle executive who doesn't really know what is going on.

Some announcements are based on a release date that may be months away. We publish it. A bug develops and the product never makes it to market. Did we lie to you? No. Did we tell the truth? No. Recently, we had a program that was sent for review along with the announcement. We got a corrected version every day for almost a week!

A much more irritating case involves the trial balloon. Product development takes time, work, and money. If there is no demand, the investment is lost. So, why not send out a new product announcement and

see how many inquiries you get? If there are enough, rush it into production. It is easy to hold off the consumer with delaying tactics such as "It's under back order", or "Demand is so great, shipment is delayed six weeks." We are not children. Development costs are understandable. Just tell us the truth.

I would love to see an announcement that says "If we get enough orders, we will do our best to produce the following fantastic program." At least then we know what to expect. It is the false promising that frustrates and angers. And, it is illegal. According to the Federal Trade Commission, companies that advertise must intend to deliver within thirty days. If they can't, they must notify customers of the delay and offer to return any money sent. Very few people order from an announcement but, if they do, they don't want their money back. They just want the product.

I believe that this is really a problem in the Model 16 market. We have yet to see any non-Radio Shack software that uses the 68000 part of the Model 16. We see announcements, we hear rumors, we hope, but we have yet to see it. One product we tried to review turned out to be a "beta" release. That is computerese for "we have not debugged it yet but we hope to."


You are the consumers. Cavaet Emptor may be the American way but you do have some protection. The Federal Trade Commission has numerous laws and regulations concerning customer satisfaction and fulfillment. Use them if you are having trouble.

All companies should instigate a policy of having the product in-house and ready to deliver before making announcements, not after. IBM's policy that a product be delivered to them, in completed form, three months prior to any announcement is to be commended. Others should try to do the same. The gain in integrity and customer faith will more than outweigh the loss of a few premature sales to another supplier.



80-U.S. on tape!

80-U.S. Journal is now available on cassette tape. Don't let long program listings keep you from getting the most from your journal.

Look for the  in the Table of Contents. That symbol is our way of letting you know that the programs in that article are available on cassette.

Model I/III and Color Computer tapes are available quarterly (every three months) for only \$9.95 (ppd.) each.

Each tape issue contains every program recorded twice, a summary sheet, any special notes, and

perhaps a bonus program from one of our past issues. Included with each tape is a postage-paid card for your vote on the best of the bunch.

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Letters to the editor

Cameron C. Brown

I just received the April issue. Several programs held my interest enough for me to stop everything and sit down at my Color Computer to try my hand at "programming" them onto a disk.

The one that interested me the most was not listed for my computer but was for the Models I and III. Well, after having worked bingo as a volunteer firefighter, I could see where it could work for most charitable organizations.

When I finished the article by David Busch called Basic Bingo, I typed in the program exactly as listed, then ran it to see how far off it was for my computer. Then I started dropping the lines that showed various errors and ran it again.

Once I had done this, I listed the program and started experimenting with the dropped lines, one at a time, trying a number of different combinations until, one by one, the dropped lines would not produce an error.

Retyping the dropped lines was easy, compared to the process of elimination by trial and error, that evolved as I started at line 1. And as the subtitle said, "Let your computer do the work." Well, I did, with each line throughout the entire program listing until it seemed acceptable to me.

King Solomon's Mine could not have held my interest more than being able to convert the program to a Color Computer, as I really got wrapped up in the project and did not stop until early in the morning.

Should you desire to pass this on, here are the changes. It is no means perfect, but it gets the job done.

The lines that I changed are as follows: Line 20 is changed to 20 AM = RND(75). Line 250 becomes 250 TA = 64. Line 280 has TA = TA + 128 replaced with TA = TA + 64. Lines 300, 310, 320, 330 were deleted and

340 is changed to 340 FOR X = 0 TO 63. Line 350 is 350 SET (X,3,3) and 360 is 360 SET (X,25,3). Note that we have added color to the display. Line 385 is added as 385 PRINT @ 424, "PRESS B FOR BINGO". Line 390 becomes 390 PRINT @ 481, "PRESS ENTER TO DRAW NEXT NO.". Line 400 is now 400 PRINT @ 10, "B I N G O ". The following lines have new PRINT @ locations: Line 410 is @456, line 420 is @470, line 440 is @456, and line 450 is @470, line 490 is @462, and line 500 is @462. Line 470 IF A\$=B\$ RUN was changed to 470 IF A\$=B\$ THEN RUN. Line 540 is rewritten to be 540 IF INT(V/15)= V/15 THEN ROW = INT(V/15): GOTO 560 and, finally, line 570 is changed to 570 P = (ROW*64 + COL*4). I hope that it will help your readers.

Donald Smith
Pittsville, MD

Thank you, we appreciate the conversion and hope other readers will let us know about their success with other programs. --Ed.

As luck, common brilliance, or pure serendipity would have it, I have made use of my versions of the string compacting techniques presented in the April issue by Terry Dettmann. I thought I would pass on my experiences in using them.

If one increases the 'offset' you used from 127 to 192, the compacted string can be printed on the screen and it will appear to be uncompact. Yet the string will have the length of the compacted version. This can save having to uncompact a string in some applications when all the user wants to do is print it on the screen. You might also note that strings compacted with either offset value cannot be compared properly for < and >.

I use a slightly different method for converting integer month, day, and year each to a two byte string. Where you used: 640 M\$ = RIGHT\$ ("00" + MID\$(STR\$(MO%), 2), 2), I use: 640 M\$ = RIGHT\$(STR\$(100 + MO%), 2).

In most applications, the approximately 16 percent improvement in speed that my algorithm offers will be trivial, but in something like an inventory program where the date of each record entry is recorded, compacted and uncompact, the difference might be of interest to your readers.

J. N. Davis
Sunnyvale, CA

I have an application that I would like to use my Color Computer for and I'm having a problem getting it to work. I have a Color Computer with 32K and Extended BASIC. I want to hook up the computer to a color TV along with a video recorder. I was hoping to be able to use the color graphics at the beginning of home video productions. Also, I would like to use it for titles, so if you know of any scrolling or marquee-type of programs, that would be helpful.

Is it possible to play one video recorder on a TV, superimpose titles via the Color Computer, and record the combination with a second recorder? Any help would be appreciated.

Rene' Cloutier
Sandown, NH

We don't have the answers here, but it sounds to us like an excellent idea. We see real problems with interference and are not sure how one could blank out the background on the Color Computer signal. TV stations do it all the time, but their

equipment is meant to be compatible. If any readers have done it, be sure to let us know. It would make a fine article.

Anent your March editorial; Bravo!!

Now, a serious question. Recognizing that Tandy seems to pay little heed to editorials, or to outraged customers, for that matter, what have you -- as a stockholder -- done to put your views directly to your company's management?

If necessary, why not organize a stockholder's revolt at the next annual meeting? It's your income they're threatening, after all.

C. Edward Chapman
Alexandria, VA

My goodness, I would never suggest a Tandy stockholder revolt. Their growth has been outstanding. But, does anyone know where the Warner Communications meeting is? -- Ed.

I wish to thank your magazine for choosing Maxi Manager as one of the six data base programs comparatively reviewed in your recent article, "Data base management", March 1983. The article was quite informative and should help your readers gain a more thorough knowledge of data base management principles. I found it quite interesting to note that Maxi Manager was the only data base program reviewed that supports both the Model I and III. Is this a growing trend?

As is the case with most reviews, errors and omissions occur. I would like to take this opportunity to point out the most obvious ones. First, the program is written in a hybrid of compiled assembly language and BASIC. This give Maxi Manager the high speed of compiled code when required. Maxi Manager II, to be released soon, increases the ratio of compiled code to BASIC even further. Secondly, the user may "alter fields after set-up", "add fields after set-up", "merge different files", and "append different files". For some reason, Mr. Klapproth stated that these features were not available. Since the price of the package was stated to be \$150, the version reviewed included the Maxi

Manager utility programs required for these and other unmentioned tasks. I can't help but wonder why Mr. Klapproth did not merely state that "this feature may be present but reviewer did not verify it." The same applies to the ability to use "special printer codes (CHR\$)", to "mass edit/purge files", and to specify fields as whole numbers. I would also like to point out that the "maximum lines per record printed" equals 255, not 66 as stated on the comparison table.

I'm sure that you are aware of the impact a review can have on future sales of a software product. In order to be as accurate as possible, I suggest that in the future, manufacturers of products being reviewed be sent advanced copies of proposed reviews, thereby allowing them to submit possible corrections or clarifications.

As an avid reader of your magazine for several years, I'm delighted that there is still someone around that treats the TRS-80 line of computers seriously. Keep up the good work.

Dale Kubler
Exador, Inc.
Author, Maxi Manager

As we stated in the article, it was not a comparison. We were trying to educate, and never meant to imply that something like dBaseII can be compared to a cassette-based Color Computer program. Your program was chosen as representative of a Model I/III program, there are others.

The flaws you noted will occur now and then, especially when there are updates and new releases as the article is being developed. In your case, we were notified that changes were coming, but we had to go on the documentation we had. We checked price accuracy via the telephone just prior to publication and we were not informed that it was for a new release we did not have.

We make every effort to have accurate and timely reviews. Forwarding them to manufacturers is often done, but in your case there was no time. But when errors occur, that is what the "Letters to editor" section is for. Thank you for writing.

--Ed.

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OMNITERM is a professional communications package for the TRS-80 that allows you to easily communicate and transfer files or programs with almost any other computer. We've never found a computer that OMNITERM can't work with. It's a complete package because it includes not only the terminal program itself, but also conversion utilities, a text editor, special configuration files, serious documentation and serious support.

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"OMNITERM has my vote as the top TRS-80 terminal program available today" Kilobaud Microcomputing, June 1981, pages 16-19.

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TRS-80 is a "™ of Tandy Corp

Notes, etc.

Cameron C. Brown, Editor

We are changing our name! The next issue you receive will be titled *Basic Computing*. We will continue to be *The TRS-80 User Journal* and are not making any changes in editorial direction or content. The problem has been one of identification. Bookstores seem to put us in the travel magazine section. Take one look at our logo and you can see why. We are also confused with *80-Micro* and the new name should help clear that up. We plan on remaining just the way you know us, but with a name that more clearly identifies who and what we are.

We are now on CompuServe. Well, not quite. After working on the November 1982 issue about telecommunications and following along with Don Stoner and the Com 80 column, I decided to take the plunge. I am now a user and look forward to learning how it all works. My first impression is that of computerized CB's, but I see real advantages to being on the system.

Bulletin Board

More importantly for you is that we have arranged for *80-U.S. Journal* to have its own bulletin

board. Just call 206/756-0448 and select the *80-U.S. Journal* "Letters to Editor" section. The board is set for 300 baud, 8 bit, no parity, and two stop bits. We will be accessing this number for your input, and it will contain recent corrections to articles and programs. There are even options for subscriptions or a complete index to articles.

The board is run by Michael Freeman, here in Tacoma, Washington and his was one of the earliest bulletin boards in the country. Mike is also the national representative for Corvus disks and TRS-80 interfacing. His help has been invaluable and we look forward to the board getting a lot of action.

Corrections

Before giving some corrections to listings, I would like to ask for your help. Every now and then we get a call or letter telling us that a program does not work. We can't do much with that information. Please let us know what kind of error and in what line it occurs. Then we can go to work on the problem, if it exists. We want to help and you can make it easier by being more exact. Thank

you.

"Right as rain", April 1983, page 29, was missing the very last data statement. Please add line 1170 DATA CLEARING AND COLDER. The diskette got slightly scrambled between the time we checked it and when we ran out a listing, sorry.

"Color Computer Compiler", March 1983, page 111, put program lines 450 and 455 together. Be sure that line 455 is separate and not made part of line 450 as we listed it. This program was quite long and if you typed it in, you could have easily confused a 1 (one) with the letter I. Also, some of the very long program lines such as 425 had linefeeds right after the line number. Our typeset machine did that, don't bother entering them.

Recent columns of "Exploring VisiCalc" included figures that gave a listing of the entries in a VisiCalc spreadsheet. The latter part of some of the figures had a section which began with just a '/'. That part gave the spreadsheet and cursor settings and are not formulas or labels to be entered. Your spreadsheet only requires the entries that begin with a > symbol.

Bequest, a game we published in

the April, 1982 issue, could use a slight change. Add a semi-colon to the end of line 160 to insure that certain maze locations are printed correctly.

Puzzler

We have yet to hear much about the April puzzles. Our January puzzler on the GOTO X has a winner, but it is not as universal as we had hoped. This one will work on a Model I or III, but not a CC or Model II. The earliest working submission, and there were hundreds, came from Daniel Schultz of ICM Industries, Carmel, IN. He used the POKE command to have the computer actually modify the resident BASIC code. Since the computer will be altering what is in program memory, be sure that you enter it exactly. Spaces are critical, since values are POKEd into them. Note that B\$ is having a string of four spaces added to it. To execute the routine, set the value of G to the linenummer you want and then either GOTO or GOSUB 65529. Feel free to use the routine in your own code, just be sure to give Mr. Schultz and ICM Industries credit for it. His code was:

```
65529 B$=STR$(G)+" ":A$="D":I=
PEEK( VARPTR(A$) +2 )*256 +
PEEK( VARPTR(A$) +1 )+102:
FORX=ITOI+4: POKE-((X>32767)
*(X-65536)) - ((X<32768)*X), ASC(
MID$(B$,X-I+2,1) ): NEXT:
GOTO65529
```

Eliminate all spaces in the code except the four in the string being added to B\$.

As we said in April, we had to get a little tougher. This problem was submitted by George A. Fenn of Mannford, OK. In assembly language, we want to swap registers A and B, without using an intermediate storage register. A BASIC swap usually goes like this: LET C=A: LET A=B: LET B=C. Try it in assembly language without the C register for a temporary storage. It can be done in three steps!

Be sure to send your solutions to Puzzler, c/o 80-U.S. Journal, 3838 South Warner, Tacoma, WA 98409. Do not send tapes or diskettes, just a listing or postcard will do. Winners receive \$10 and a free tour of our facilities.

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EMTROL Systems Lynx modem is an auto dial auto answer modem for use on TRS-80 Model 1 or Model 3 with or without an RS-232 interface. That's right, this modem includes an RS-232 interface internally, so you can use it on any TRS-80 computer, even if you don't have an expansion interface or RS-232 board installed.

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The Model 4

State-of-the-art from the Tandy Corp.

Cameron C. Brown, Editor

Radio Shack's Model 4 computer has been the subject of many rumors for quite a few months. I was able to work on one for a few hours and have had a chance to study the operator's manual and other documents. This report is based upon that brief experience with the machine. We will be giving more in-depth information as we continue our work on it.

Describing the Model 4's market is difficult. It is a Model II in Model III clothing. It offers true state of the art and a definite upgrade for existing Model I and III owners. For new purchasers, it allows a flexibility in Operating Systems and configuration that is way beyond anything that Tandy has yet produced. The Model 4 offers all the performance of the Lobo Max-80 or Apple IIe (except color) for a very reasonable price, backed with Radio Shack support and local service. The Model 4 is destined to be the standard Radio Shack computer for the next few years.

The Hardware

The Model 4 uses a 4MHz Z-80 and is expandable to 128K RAM. There are four selectable video modes (80x24, 64x16, 32x16, or 40x24), upper and lowercase, and reverse video. The disk system uses 40-track, single-sided, double-density drives and the two disk version comes with a built-in RS-232. It has sound generation, three function keys, a numeric keypad, a caps key, and a control key. A high resolution graphics board option will be available and a 34-pin parallel printer interface is included. The computer is housed in one unit, like the Model III, is white, with a black and white video. A 64K, two-disk system sells for only \$1999.

Cassette System

Until you add disks to the Model 4,

it is practically identical to the current Model III. You can purchase a 16K cassette version for \$999. A 64K upgrade is available for \$149 when adding disks to the unit or when going from 64 to 128K. The built-in ROM in the cassette system is identical to that in the Model III. This ROM should be able to identify 48K of the 64K RAM addition, but not all of the 64K.

The Disk Version

Once disks are installed, the Model 4 becomes a new, RAM-based computer. TRSDOS 6.0, developed by Logical Systems Inc., is the standard operating system. TRSDOS 1.3, used when running in its Model III mode, is not included since it comes with all Radio Shack application software. The easiest way to view the machine is like this: Under TRSDOS 1.3 it is a Model III. Boot TRSDOS 6.0 and the ROM

switches out and it is a RAM-based Model 4. Owners also have the option of running CP/M 3.0, developed for Tandy by the Digital Research Corporation. It should be released soon.

The disk-based system is expandable to 128K, which is bank selectable in units of 32K. TRSDOS 6.0 supports full routing, device selecting, floppy and hard disk assignment. The current 5Meg hard disk for the Model III will work on the Model 4. By defining the devices, you can easily select any drive to be drive 0 for booting or mix and match 5¼" single- or double-density drives, as well as determine stepping rates and delay times.

Job Control Language or JCL files are allowed and they are a key to effectively using many of the features of the Model 4. There is also filtering, spooling and other DOS operations. TRSDOS 6.0 includes a BASIC that is similar to MBASIC



5.0. Since the machine is RAM based, PEEKS and POKES are not implemented; their function is replaced by invoking supervisor calls (SVCs), such as those used on the Model II. Assigned ports are different than the Model III's.

The power of the Model 4 becomes clear when you look at its operating system. The system comes with a terminal program called COM and other filters (utilities) such as MEMDISK and FORMS. MEMDISK allows you to load system and program files into memory and greatly increase operating speed. The FORMS command allows setting of lines per page, characters per line, page size, indents, and translation of characters. Its flexibility is indicative of most of the command set in TRSDOS 6.0. The library is extensive and very much like LDOS. An extensive directory command gives date of modification, attributes, file size, and more in alphabetical order. The library command shows the following: Append, Link, Route, Copy, Device, Load, Set, Do, Remove, Filter, Rename, Lib, Reset, Attrib, Free, Auto, Purge, Build, Time, Create, Verify, Date, Debug, Dump, Forms, Setcom, Setki (keyboard filtering), Spool, Sysgen, and System. It is the kind of operating system that will make many programmers and users

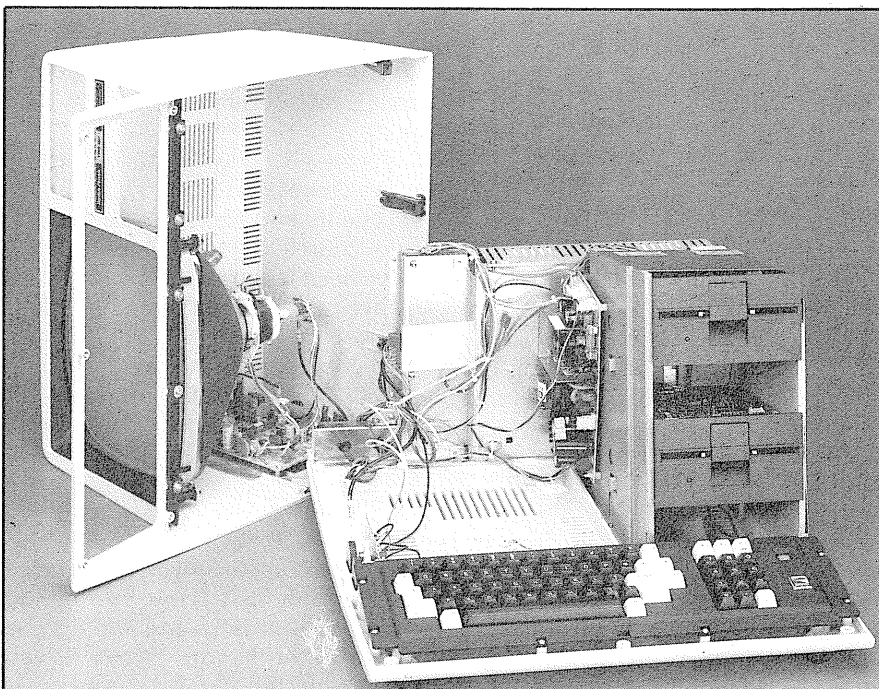
happy.

Disk BASIC

TRSDOS 6.0 is RAM based and cannot access TRSDOS 1.3 ROM subroutines. It has no cassette support and is strictly disk oriented. Many new commands are implemented, such as, RENUM, ROW, SPACE\$, WHILE ... WEND, WRITE# and others. The following commands are not recognized by TRSDOS 6.0: CSAVE, CLOAD, POINT, CLOCK, CMD (replaced with SYSTEM), POS(N), RENAME, and VERIFY.

For the BASIC programmer there are significant differences, and in converting programs over from TRSDOS 1.3 to 6.0 you need to be careful. Print zones are 20 characters, not 16. Variable names can be up to 40 characters long, not just two. This demands that all keywords be separated by a space (e.g. DEF FN not DEFFN). Under TRSDOS 6.0 BASIC, the FOR ... NEXT loop is not automatically passed through once and then checked. The THEN on a conditional statement is required.

When variables are converted to integers, they are rounded, not truncated. Under TRSDOS 1.3, TAB(4.5) would go to position 4, while under TRSDOS 6.0 it would go to position 5. Overflow errors, such



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Model 4

as division by zero, can now be trapped and are recoverable. TRSDOS 6.0 performs dynamic string allocation and no CLEAR statement is needed. The CLEAR command is now used to save specific memory locations for assembly language routines or drivers. BASIC statements can only be 249 characters long, the last six bytes are reserved for line numbers.

Documentation

The Model 4 disk operating manual is quite complete, but it is lacking in material on the Supervisor calls and other uses of TRSDOS 6.0. Some applications of JCLs are discussed, but the new owner of a Model 4 will have many questions about their use and utilities such as MEMDISK. It does an excellent job of discussing the enhancements and differences from Model III or I BASIC. For owners of other models of TRS-80, the appendices will be invaluable. The DOS manual is complete, but not as technical as what LDOS users are used to. Included is an introductory manual that is excellent. It takes a first-time user through loading BASIC, running a simple application program called Maillist and does a fine job of getting the novice on his way. Clearly, Radio Shack has thought about the end-user and what questions he may have. There is also a small reference manual for easy look-up of command syntax and usage.

Compatibility

"I took it once on the Model I/III incompatibility and I won't go through that again," said Don White, Model 4 product line manager. By inserting a Model III TRSDOS 1.3 disk into drive 0, it will act as a Model III. The built-in self-booting ROM recognizes the Model III diskette and acts accordingly. The hardware is designed to include cassette I/O and Model III port assignments. It is only when you are running TRSDOS 6.0 or CP/M 3.0 that you are in a completely disk-oriented system. Actually, that is not quite true. There is a TRSDOS 6.0 program called TAPE100 which allows tape to disk, and the reverse, communication to a Model 100. Since the leader format on the Model

100 is unlike the Model III, don't plan on loading Model I/III tapes into TRSDOS 6.0.

TRSDOS 6.0 includes a convert program, CONV, for moving data and BASIC ASCII files over from TRSDOS 1.3. Remember, application programs written for TRSDOS 1.3 have to be run under TRSDOS 1.3, they will not run under TRSDOS 6.0. Under TRSDOS 6.0, the formatting is different, so, TRSDOS 6.0 can read 1.3 but TRSDOS 1.3 cannot read 6.0. To use TRSDOS 1.3 programs, you must boot-up with it in drive 0. In this way, all Radio Shack software will operate and the machine is completely Model III compatible. For most applications, there will not be a re-release of TRSDOS 6.0 versions. Radio Shack is working on 80-column versions of VisiCalc, SuperScripsit, and Scripsit that will take advantage of the new video format, but no release date has been set.

Upgrades

Current Model III owners can have their machines converted into Model 4s, but there are some differences. For \$799, you get a complete board swap, 64K RAM (200 ns), TRSDOS 6.0, a new keyboard and sound board, reference card and operator's manual. The board swap is complete and your old Model III board and RAM is not returned. You do not get a new casing, disk drives, RS-232, or monitor. If you start with a cassette version of the Model 4, the first disk add-on costs \$649, the next disk is \$240, and the 64K RAM kit is \$149.

For new owners, the Model 4 offers a price-to-performance ratio that is excellent. For Model I owners, it is the complete improvement they have been looking for. For Model III owners, it guarantees that their software investment is not lost, and they can upgrade without having to purchase a complete unit. Model II users will feel right at home with TRSDOS 6.0 and its RAM based outlook. Advanced programmers will find power and utility in TRSDOS 6.0. The use of CP/M 3.0 will open up a world of existing application software for many businesses. It is impossible for one machine to be all things to all people, but the Model 4 comes close.

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A review

Pat Perez, Tacoma, WA

80-US received a large package from Radio Shack. Inside were many programs for review, ranging from Model II accounting packages to PC-2 engineering programs. The bulk of the material was for the Color Computer, and almost all of them were games. We decided to call in a true game fanatic, who happens to sell Ataris, for his evaluation. What better reviewer could there be than a man who makes a living selling a games machine? His evaluation is what follows.--Ed.

My game rankings are purely subjective, and may be slightly slanted since I get to see the magic graphics that are available on the video machines from Atari, Coleco, and Mattel. The machines from Tandy hold their own against the video game competition, and are much more useful.

Table one gives a breakdown of all the cartridges as judged in various categories. Enjoyability is my measure of the game's longevity or ability to be enjoyed over a period of time. Graphics is a measure of both animation and image quality. Sound is based on how often there is something to hear and whether or not it becomes abrasive. Fun is pretty self-explanatory, as judged by a now reformed Pac-Man fiend who currently crazes Star Raiders. Complexity is a measure used to weed out the sophisticated from the younger kids stuff. Don't be discouraged by the number of "fair"

ratings. To me, fair is just that, nothing spectacular, nothing terrible. Now, on to the games.

Monster Maze is an imitation of the arcade game Berzerk. Its objective is to guide you through rooms populated with evil monsters trying to kill you.

Castle Guard is a fairly original game in which one or two players try to destroy each other's castle by bouncing a magical fireball (sent to earth courtesy of Merlin the Magician).

Shooting Gallery, the county fair favorite. Shoot the moving targets but don't waste precious bullets.

Polaris, another arcade look-alike, is a Color Computer version of Missile Command. Destroy the ICBMs and protect your coastal cities.

Poltergeist, the first in the "see the movie, play the computer game" trend for Radio Shack, challenges you to rescue little Carol Ann from the evil poltergeists. You have to maneuver through three different series of obstacles.

Project Nebula, Radio Shack's answer to Star Raiders, is a pale imitation of the legendary Atari program. But Atari computers were designed with Star Raiders in mind and they have certain hardware advantages in playing this game. Project Nebula is a space mission in which you have to destroy aliens in as little time as possible. All the while, you have to conserve fuel and

protect the star bases.

Bustout is a Breakout twin, but better than the original. Bounce the moving ball to remove bricks from a barrier. Gravity options improve on the original.

Microbes was formally called Color Meteoroids and was reviewed in the February 1982 issue of *80-US Journal*. It puts the player inside a human body, battling diseased cells. It is the game Asteroids, repackaged.

Roman Checkers is Othello, or Reversal, played on an eight-by-eight grid. You try to get as many pieces on the board as possible while at the same time blocking your opponent. This game can involve a strategy as deep as that in chess.

Popcorn has the player maneuvering a series of baskets in order to catch falling popcorn kernels. It gets hectic, but is always fun.

Clowns and Balloons has you moving a trampoline to keep a clown in the air (and alive) so he can pop the balloons that are passing by overhead.

Space Assault is a space invaders replica. It is more challenging than the original. Your goal is to blast the invaders and protect the earth.

Wildcatting is an original game that has players searching for oil. Beware of dry holes, they cost money. In fact, even holes with oil may not pay off due to drilling costs, and taxes. Play J.R. Ewing without

the family problems.

Mega-Bug is a Pac-Man derivative. Your "mouth" is moving through a large maze, all the while being chased by eight unnamed insects. Only a part of the maze is seen, through a moving magnifying glass; everything else is small, but legible.

Sands of Egypt is a constantly animated and graphic adventure. You see where you are going as well as moving scenery. If thirst becomes a problem you even see your own grave. The challenging puzzle makes this a top-rate adventure.

Raaka-Tu, Pyramid 2000, and Bedlam are text-only adventures. Raaka-Tu has you leading a Himalayan expedition to find a missing tribe. Pyramid 2000 is a standard find-the-treasures adventure. This one uses the great pyramids of Egypt for its locale. Bedlam has you trying to escape from a bizarre mental institution. The maze is different each time you play.

Color Cubes is a microcomputer

Ratings are P (poor), F (fair), G (good), E (excellent), K (keyboard alone will work), J (joystick required), D (disks required), N (not offered in this game).

NAME	CAT#	Price	1	2	3	4	5	6	7
26-									
Monster Maze	3081	29.95	F	G	F	G	1	F	J
Castle Guard	3079	29.95	G	E	F	G	1-2	G	J
Shooting Gallery	3088	29.95	F	E	F	F	1	F	J
Polaris	3065	29.95	G	F	F	G	1-2	G	J
Poltergeist	3073	34.95	G	G	F	G	1	G	J
Project Nebula	3063	39.95	F	G	F	F	1	G	J
Bustout	3056	29.95	F	F	F	F	1-4	F	J
Microbes	3085	24.95	G	G	F	G	1	G	K,J
Roman Checkers	3071	29.95	F	F	F	F	1-2	G	K,J
Popcorn	3090	24.95	E	G	G	E	1	G	J
Clowns & Balloons	3087	29.95	G	E	G	E	1	G	J
Space Assault	3060	29.95	G	E	G	G	1	G	J
Wildcatting	3067	29.95	F	G	F	F	1-4	G	K,J
Mega-Bug	3076	34.95	G	F	E	G	1	G	J
Sands of Egypt	3290	29.95	G	E	N	G	1	G	K,D
Raaka-Tu	3311	14.95	F	N	N	F	1	G	K
Pyramid 2000	3310	14.95	F	N	N	F	1	E	K
Bedlam	3312	14.95	G	N	N	G	1	G	K
Color Cubes	3075	29.95	E	E	N	E	1	E	K

version of the famous Rubik's Cube. You try to solve the cube on your video screen. Seeing a three-dimensional cube on a two-dimensional video takes getting used to, but a handy keyboard

overlay is provided for the weak of heart.

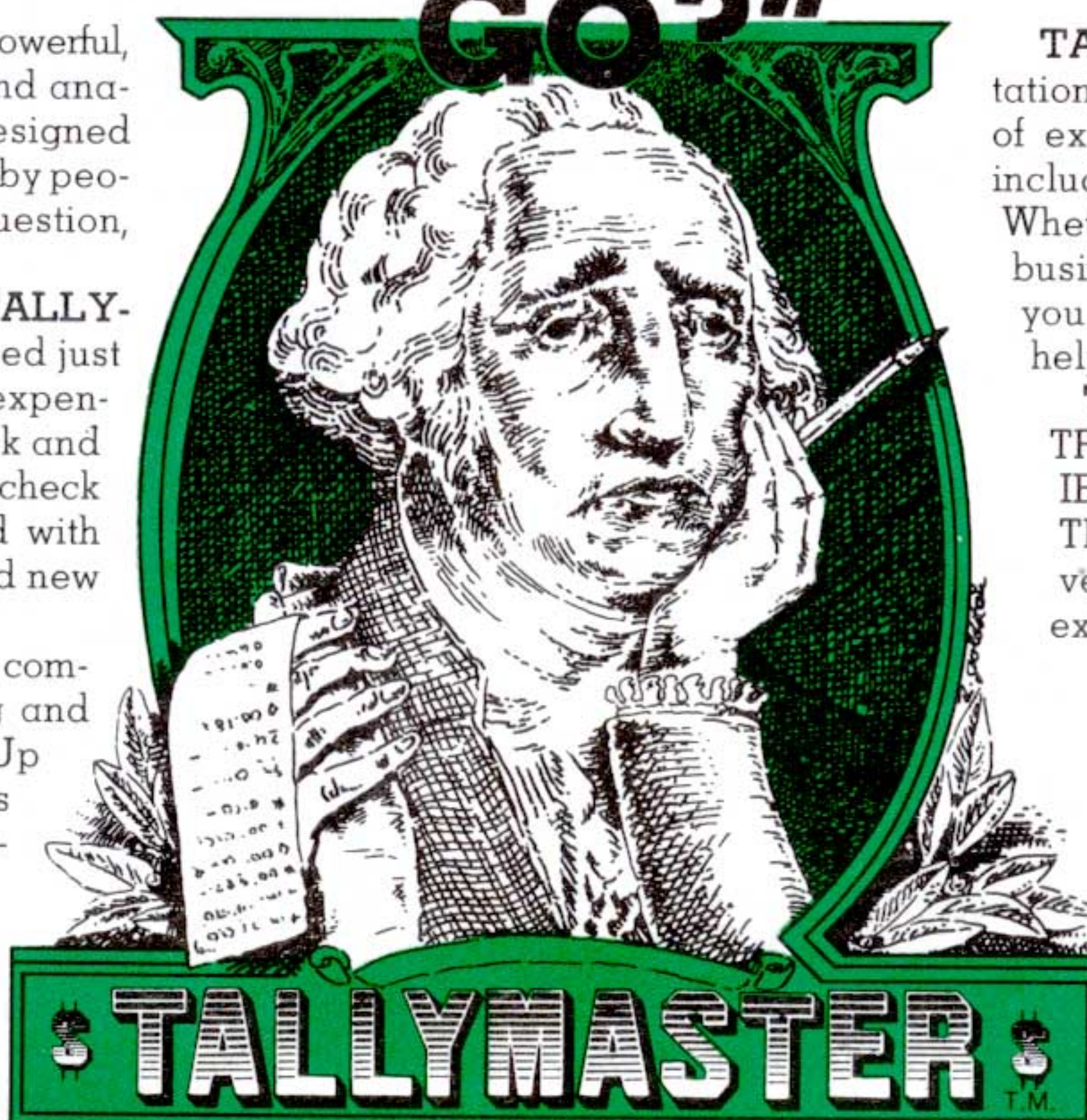
All in all, no real dogs in the bunch. Not all appealed to me, but my tastes in computer games are unique.

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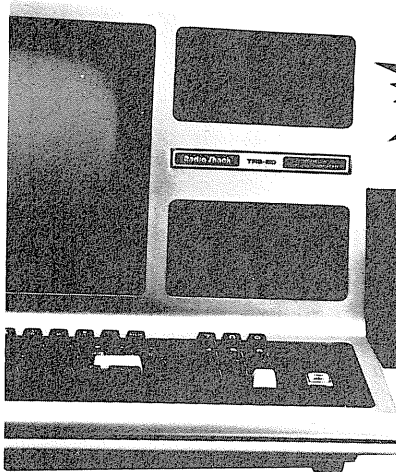
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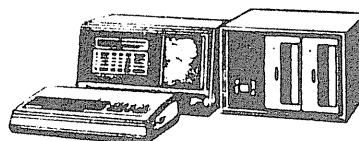
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Keno

Why go to Nevada for a casino game?

Models I/III

Steve Rickman, Sacramento, CA

There is a story that the popular casino game called Keno is descended from an ancient Chinese lottery which the emperors used to finance the Great Wall. Whether that's true or not, the game does have an oriental flavor. Although it appears childishly simple and easy to beat, it is based on a complicated system of probabilities and payoffs which insure that the house, in the long run, will be the winner.

In the short run, anything can happen. One attraction of this addictive game is that a bet as small as \$2 can win \$50,000. Such a win is far from likely, but it is possible.

This program, called Keno, simulates the game as it is played in Nevada. It is written in Level II BASIC and requires at least 16K of RAM.

The Casino Game

In the mechanics of play, Keno is similar to that old standby, bingo. In a large bowl, there are 80 numbered balls. Before the game starts, each player obtains a "ticket" printed with the 80 numbers. He then marks from one to fifteen spots (i.e., the numbers he wants to bet on).

After marking his spots, the player submits the ticket at the Keno desk and places a bet, called the ticket price. He receives a duplicate ticket in return as a receipt. Usually, the minimum bet is \$1 if ten or fewer spots are marked, and \$2 for eleven to fifteen spots. The maximum bet is typically \$500.

Any number of players may submit tickets for a particular game (and the more, the merrier for the casino). After a predetermined interval, the Keno desk closes and the game begins. The balls in the bowl are thoroughly mixed and then twenty of them are drawn in succession. As each ball is drawn, the number is announced and it is also lit up on a large display board which looks like the Keno ticket.

Meanwhile, the player compares his ticket to the drawn numbers. He wins if a certain minimum count of his spots are among the drawn numbers. The more numbers he "catches" the greater the payoff. Since there are 120 possible combinations of spots and catches, the

casino makes available a leaflet containing a payoff table.

Playing Keno

Playing Keno is similar to the casino game. At the beginning, you are presented with a graphic Keno ticket and asked to enter your spots. As each spot is entered, it is marked on the ticket with parentheses. A "spots marked" display keeps a running count of the number of spots entered. The program will not accept invalid entries, such as spots out of range (less than one or greater than 80), spots already marked, or more than fifteen total spots. The only alphabetic characters it will accept are the commands "S" (start), "P" (payoffs), and "E" (erase).

The erase command removes all marks from the ticket and resets the spots marked counter to zero. You would use it if you found that you had made a mistake or decided to change the ticket.

The payoffs command switches the display to a payoff table which shows the amount you win for any given number of catches with any number of spots marked. The amounts shown in the payoff table are for a minimum bet of \$1 or \$2 as applicable. Naturally, the amount you win is proportional to the amount you bet. For example, if you bet the minimum \$1 on a four-spot and catch three, you would win \$4. If you had bet \$2, you would have won \$8. Incidentally, the payoff table is identical to that of a major Nevada casino.

By repeatedly hitting ENTER, you can scroll through the payoff table from one spot to fifteen spots. Hitting "1" returns you to the Keno ticket, with all previously marked spots still shown.

When you enter the start command, you are first asked for your bet. If you simply hit ENTER in response, the minimum bet will be used. After the bet is entered, the twenty numbers are drawn in succession, about one second apart. As each number is drawn, it is marked on the ticket. If the number is not a catch, it is marked on the ticket with a pair of bars. If it is a catch, the entire number is whited out. Meanwhile, two displays below the ticket keep count of how many numbers have been

drawn and how many catches have occurred.

The drawing sequence is as random as the Level II RND(X) function, and the statistics of catches for spots marked match the theoretical odds very closely.

When all twenty numbers have been drawn, the results are displayed, showing the original ticket price, the winnings, if any, and the net gain or loss since play began. Hitting any key will begin a new game. The original spots are not automatically erased for the new game, so you can replay the same ticket by entering "S" for start.

The Odds of Keno

After a few games of Keno, you may begin to wonder what the true odds of this game are? What is the best ticket to play? Is there a real chance of coming out ahead?

Some of these questions may be answered with the short program called Keno Odds. This program calculates the theoretical probabilities of all spot/catch combinations.

I won't try to define the probability here. A formal definition would require too much explanation, while an informal definition would likely be misleading. However, I do need to explain the numerical evaluation of probability so that the results of the program can be understood.

By convention, the probability of an event can be expressed as a number between zero and one. A probability of exactly one means absolute certainty — the event will always occur in every trial. For example, in Keno, the probability is one that all twenty numbers drawn will lie between one and 80. A probability of zero also means certainty, but with a negative emphasis — the event will never occur in any trial. In Keno, the probability is zero that a particular number will be drawn twice in a row.

Of course, the interesting probabilities lie between zero and one. A probability of .25 means that if there is a very large (technically, infinite) number of trials, the event will occur in twenty-five percent of the trials.

Suppose that I mark a one-spot Keno ticket. As the Keno Odds program will display, the probability that I will catch the single spot is .25. The probability that I will not catch the spot is .75. Notice that the two probabilities add up to one. This should make sense because there are only two possible outcomes to the game: I catch the spot or I don't. That one of these two events will occur is a certainty.

Suppose that I play just four, one-spot games. Can I definitely say that I will catch the spot in one game and not catch it in the other three? No, I can't. If the number of trials is small, probability is "grainy." Only if the number of trials is very large will the probability values definitely be borne out. Nevertheless, if you're wagering, a good bet is that I'll catch the one-spot just once in four games.

An interesting thing to do is to compare the probability table with the payoff table in the game program. For example, according to the payoff table, if I catch a one-spot and I've bet the minimum \$1, I win \$3. The probability is that (in the long run) I will catch the one-spot just once in every four games. Therefore, for every

\$4 I bet, I can expect to win \$3. As it turns out, this is typical of the expectation for tickets with any number of spots. If you multiply the winnings for each catch by the probability of that catch and sum them all up, you find that you can expect a return of from sixty-nine to seventy-five cents on the dollar (in the long run).

Interesting Observations

Your best chance of winning the \$50,000 limit on a \$2 bet is by catching thirteen spots out of fifteen marked. The probability of that occurring is 2.06771E-08, which corresponds to one chance in 483,626,681. (If you ever hit it, would you write and let me know?)

The best ticket to play to have a chance of winning something, and maybe keep you playing, is the four-spot. The total probability that you will catch either two, three, or four spots to win is .25895.

The ticket on which you are least likely to win anything is the eight-spot. The total probability that you will catch a winning number of spots is only .020834, or one chance in about 48.

Arguably, the best all-around ticket to play is the fifteen-spot. The total probability of winning something is .125006, which is third best, after the four-spot and six-spot. However, playing the fifteen-spot puts you in line for the big money wins, which is the only way you can expect to profit from Keno.

The Odds Program

The odds program itself is based on a rather complicated algorithm which I won't attempt to explain or prove. It is here on an "as is" basis without any sort of warranty, and I don't advise anyone to risk real money on the basis of it.

Because the algorithm uses the slow LOG(X) and EXP(X) functions in an iterative loop, it is quite slow. When you run it, the first result will not appear for about seven seconds. The entire program takes about twenty minutes.

If you have a line printer, you can get a printout just by changing all of the PRINT statements to LPRINT.

The table produced by the program has four columns. Column 1 is the number of spots marked. Column 2 is the number of catches for which probability is calculated. Column 3 is the probability of that number of catches with that number of spots marked. Column 4 is the cumulative probability — that is, the probability that you will catch either the current number of spots calculated, or more.

Program Listing for Keno

```
10 REM *****
20 REM *          KENO!          *
30 REM *   COPYRIGHT 1982   *
40 REM *          BY          *
50 REM *   STEVE RICKMAN   *
60 REM *****
70 REM VER. 1.0 4/4/82
80 REM
90 REM
100 REM          INTRO
```




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Who knows graphics better than Epson?

Nobody, that's who. And if you don't believe it, witness the FX-80.

With a 12K ROM capacity, the FX-80 gives you a few things the others don't. For example, not one, not two, but *seven* different dot addressable graphic modes are program

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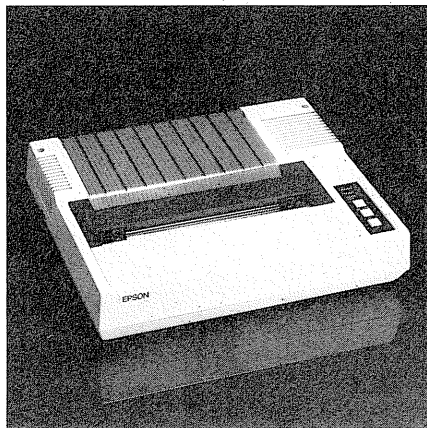
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We'd be willing to bet that the FX-80 — like the MX-80 — will have its share of imitators. Don't be fooled. To make sure you get the genuine article, rush down to your local computer store right now and let them show you everything the FX-80 can do.

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```

110 REM
120 CLS:PRINT @472,"K E N O !";
130 S$="* * * * *":PRINT @406,S$;:PR
INT @534,S$;
140 FOR K=1 TO 4
150 GOSUB 1390:PRINT CHR$(23):GOSUB 1390
:PRINT CHR$(28);:NEXT
160 PRINT @960,"":FOR K=1 TO 5:PRINT:NEX
T
170 PRINT @256,"KENO IS A GAME OF LUCK A
ND INTUITION..."
180 PRINT:PRINT "IN A BOWL THERE ARE 80
NUMBERS. YOU MARK A CARD WITH FROM"
190 PRINT "1 TO 15 OF THESE NUMBERS. YOU
R CHOICES ARE CALLED 'SPOTS'."
200 PRINT:PRINT "AFTER YOU PLACE YOUR BE
T, 20 NUMBERS ARE DRAWN FROM THE BOWL."
210 PRINT "IF YOU 'CATCH' ENOUGH OF THE
NUMBERS DRAWN, YOU WIN...UP TO"
220 PRINT "$50,000."
230 PRINT:PRINT "...COMPUTER MONEY, OF C
OURSE!"
240 REM
250 REM          FILL ARRAYS & INITIALIZE
260 REM
270 CLEAR 250:DIM L(80),D(80),B(80),P(15
,15),P$(13):Z=1
280 FOR J=64 TO 576 STEP 64
290 IF J=320 THEN J=384
300 FOR K=3 TO 62 STEP 3
310 L(Z)=K+J:Z=Z+1:NEXT K,J
320 FOR J=1 TO 15
330 READ E
340 FOR K=0 TO E-1:P(J,K)=0:NEXT
350 FOR K=E TO J
360 READ PB:P(J,K)=PB
370 NEXT K,J
380 FOR K=1 TO 13:READ P$(K):NEXT
390 RANDOM:C=0:TTL=0:FOR J=1 TO 80:D(J)=
J:NEXT
400 REM
410 REM          START GAME
420 REM
430 PRINT @960,"HIT ANY KEY TO START THE
GAME...GOOD LUCK!";
440 GOSUB 1360
450 GOSUB 490:GOTO 560
460 REM
470 REM          TICKET GRAPHICS
480 REM
490 CLS:PRINT @0,STRING$(23,131);" K *
E * N * O ";STRING$(24,131);
500 FOR J=0 TO 640 STEP 64:PRINT @ J,CHR
$(191);:PRINT @J+63,CHR$(191);:NEXT
510 PRINT @641,STRING$(62,176);:PRINT @3
21,STRING$(62,140);
520 RETURN
530 REM

```

```

540 REM          TICKET ROUTINE
550 REM
560 FOR J=1 TO 80:PRINT @L(J),J;
570 IF J<10 THEN V=2 ELSE V=3
580 IF D(J)=0 PRINT @L(J),"(";:PRINT @L(
J)+V,") ";
590 NEXT J
600 PRINT @704,"ENTER SPOT...ENTER 'S' T
O START, 'E' TO ERASE, 'P' FOR PAYOFFS"
610 PRINT @832,"SPOTS MARKED:";C;CHR$(31
);
620 I$="81":I=VAL(I$)
630 PRINT @896,CHR$(29);:INPUT I$
640 IF I$="E" FOR J=1 TO 80:D(J)=J:NEXT:
C=0:GOTO 560
650 IF C>10 THEN MIN=2 ELSE MIN=1
660 PR$=STR$(MIN)
670 IF I$="S" PRINT @896,"ENTER BET, $";
MIN;" TO $ 500 (DEFAULT IS $";MIN;"");:I
NPUT PR$:PR=VAL(PR$):IF PR<MIN OR PR>500
PRINT @896,CHR$(30);:GOTO 660 ELSE 940
680 IF I$="P" GOSUB 780:GOSUB 490:GOTO 5
50
690 I=VAL(I$):IF I<1 OR I>80 PRINT @896,
"HUH?":GOSUB 1400:GOTO 610
700 IF C=15 PRINT @896,"15 SPOT LIMIT":G
OSUB 1400:GOTO 610
710 IF D(I)=0 PRINT @896,"ALREADY MARKED
":GOSUB 1400:GOTO 610
720 D(I)=0:IF I>9 THEN V=3 ELSE V=2
730 PRINT @L(I),"(";:PRINT @L(I)+V,")";
740 C=C+1:GOTO 610
750 REM
760 REM          PAYOFF TABLE
770 REM
780 CLS:PRINT @25,"PAYOFF TABLE"
790 PRINT @74,"PAYOFFS SHOWN ARE FOR MIN
IMUM TICKET PRICE."
800 FOR J=1 TO 15
810 IF J>10 THEN MIN=2 ELSE MIN=1
820 PRINT:PRINT J;"SPOTS-$";MIN;"TICKET"
830 PRINT "CATCH","PAYS"
840 FOR K=0 TO J
850 IF P(J,K)=0 THEN 870
860 PRINT K;TAB(12);:PRINT USING "$$####
#,";P(J,K)
870 NEXT K
880 PRINT:PRINT TAB(30)"<ENTER> TO CONTI
NUE, 1 TO RETURN";
890 GOSUB 1360:A=ASC(A$):IF A=49 RETURN
ELSE IF A<>13 THEN 880
900 NEXT J:GOTO 780
910 REM
920 REM          DRAW & TALLY
930 REM
940 CTCH=0:CF=0:W=80:PRINT @704,"SPOTS M
ARKED:";C;TAB(23)"DRAWN:";0;TAB(40)"CAUG
HT:";CTCH;CHR$(31);

```



```

950 FOR J=1 TO 80:B(J)=J:NEXT
960 FOR I=1 TO 20
970 X=RND(W):NUM=B(X)
980 IF D(NUM)=0 THEN CTCH=CTCH+1:GOSUB 1
180:PRINT @751,CTCH:GOTO 1010
990 IF NUM<10 THEN V=2 ELSE V=3
1000 GOSUB 1270:GOTO 1050
1010 IF P(C,CTCH)>0 THEN CF=CF+1
1020 IF CF=1 PRINT @800,"IN THE MONEY!";
1030 IF CF=2 PRINT @800,"BETTER YET! ";
1040 IF CF=3 PRINT @800,"* BIG WIN!! *";
1050 B(X)=B(W):W=W-1
1060 PRINT @733,I;
1070 NEXT I
1080 PAY=P(C,CTCH)*PR/MIN:IF PAY>50000 THEN PAY=50000
1090 TTL=TTL-PR+PAY:TA=ABS(TTL):IF TTL>=0 THEN B$="GAIN" ELSE B$="LOSS"
1100 PRINT @768,"$";PR;"TICKET PAYS $";PAY,
1110 IF PAY>0 PRINT "CONGRATULATIONS!" ELSE PRINT P$(RND(13))
1120 PRINT @832,"NET ";B$;" OF $";TA
1130 PRINT "HIT ANY KEY FOR NEW GAME";
1140 GOSUB 1360:GOTO 560
1150 REM
1160 REM      MARK & FLASH A CATCH
1170 REM
1180 GOSUB 1390:GOSUB 1220
1190 GOSUB 1230
1200 GOSUB 1220
1210 GOSUB 1230
1220 PRINT @L(NUM),CHR$(138);STRING$(2,143);CHR$(133);:GOSUB 1380:RETURN
1230 PRINT @L(NUM),NUM;" ";:GOSUB 1380:RETURN
1240 REM
1250 REM      MARK & FLASH NUM DRAWN
1260 REM
1270 GOSUB 1390:GOSUB 1310
1280 GOSUB 1320
1290 GOSUB 1310
1300 GOSUB 1320
1310 PRINT @L(NUM),CHR$(138);:PRINT @L(NUM)+V,CHR$(133);:GOSUB 1380:RETURN
1320 PRINT @L(NUM),NUM;:GOSUB 1380:RETURN
1330 REM
1340 REM      DATA & SUBS
1350 REM
1360 A$=INKEY$
1370 A$=INKEY$:IF A$="" THEN 1370 ELSE RETURN
1380 FOR TD=0 TO 100:NEXT:RETURN
1390 FOR TD=0 TO 200:NEXT:RETURN
1400 FOR TD=0 TO 400:NEXT:RETURN
1410 DATA 1,3,2,12,2,1,42,2,1,4,113,3,1,9,820,3,1,3,90,1800,4,1,20,410,8100,5,9,

```

```

90,1650,18000,5,3,45,335,4700,18500,5,2,20,142,1000,4500,19000,6,20,150,760,4000,25000,39000
1420 DATA 6,12,56,400,1700,4800,26000,5000,6,4,32,156,1400,7200,18000,50000,5000,6,6,16,64,600,1600,5000,24000,50000,50000,6,4,16,42,150,480,4800,16000,50000,50000,50000
1430 DATA BETTER LUCK NEXT TIME,I'M READY TO PAY,TICKLE MY KEYS?,I FEEL IT COMING...,ONE MORE TIME...,DON'T STOP NOW,NEXT TIME,LAW OF AVERAGES...,GOTTA WIN IT BACK!,YOU LOVE THIS GAME,MUST BE THE PROGRAM,THE BREAKS...,QUITTERS NEVER WIN

```

Program Listing for Odds

```

10 REM      * KENO ODDS *
20 REM
30 REM  CALCULATES AND DISPLAYS PROBABILITY OF ALL SPOT/CATCH COMBINATIONS.
40 REM
50 DIM C(16):Z=3.53538E18
60 CLS:PRINT "KENO ODDS":PRINT:PRINT"SPOTS","CATCH","PROBABILITY","CUMULATIVE"
70 FOR H=0 TO 16:C(H)=0:NEXT
80 FOR S=15 TO 1 STEP -1
90 FOR H=0 TO 15:C(H)=0:NEXT
100 PS=0
110 FOR H=S TO 0 STEP -1
120 N=S:M=H:GOSUB 270:F1=C0
130 N=80-H:M=20-H:GOSUB 270:F2=C0
140 SUM=0
150 FOR I=H+1 TO S
160 N=I:M=H:GOSUB 270
170 SUM=SUM+C(I)*C0
180 NEXT I
190 C(H)=F1*F2-SUM
200 PS=PS+C(H)
210 PRINT S,H,C(H)/Z,PS/Z
220 NEXT H:PRINT:NEXT S
230 END
240 REM
250 REM      COMBINATIONS
260 REM
270 A=N:GOSUB 350:N1=LF
280 A=M:GOSUB 350:M1=LF
290 A=N-M:GOSUB 350:D1=LF
300 C0=EXP(N1-(M1+D1))
310 RETURN
320 REM
330 REM      LOG FACTORIAL
340 REM
350 LF=0
360 IF A=0 OR A=1 RETURN
370 FOR K=1 TO A:LF=LF+LOG(K):NEXT
380 RETURN

```


Special section: Low-cost ideas for your computer

Lowercase and more

Lowercase your Model I and more for \$4.98

Model I only

Kenneth Goodwill, Philadelphia, PA

Did you ever have the feeling that your TRS-80 was hiding something from you? If you did, you're right. The Model I has the built-in power to display lowercase letters and thirty-eight other symbols. With a little effort and \$4.58 in parts, you can see and use these hidden characters.

I must give credit for the initial idea to Dennis Kitsz and his outstanding book, *The Custom TRS-80*. I built the lowercase modification from his book, but it didn't work. Most likely, this was due to the dead gate on Z25 that he warns you about. Although it didn't work, it did let me see the "special control characters" briefly mentioned by Mr. Kitsz. I decided that I had to have those special characters, so I redesigned the circuit.

Theory

The Model I was built with one bit of video memory missing. This modification fills in that missing bit but lets you determine, via a switch, whether or not the computer will see the restored bit.

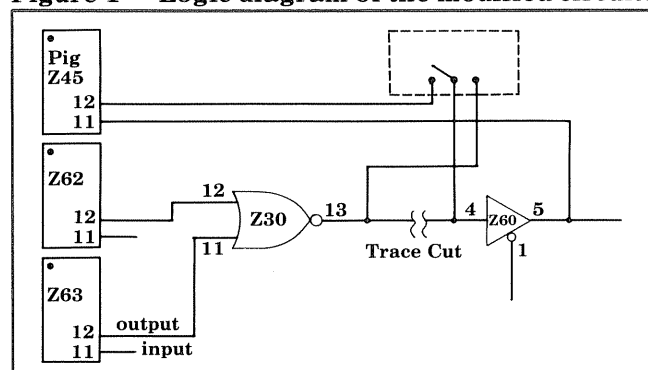
Originally, the missing bit was formed by NORing together the bits adjacent to the absent one. With the added SPDT (single pole, double throw) switch in one position, the missing bit is still formed by combination. In this mode, the added bit can be written to, but not read. When the switch is in the other position, the computer can read the bit you have added. The added bit is now independent of the bits adjacent to it. By using this setup (see Figure 1), the modification can be made invisible to the computer, thus eliminating possible problems with program incompatibility.

Construction

This project requires only two parts in addition to some wire. Any thin, single-strand wire will do. I used 24-gauge. The most important is the 1024×1 bit static RAM (generic code 2102). This can be bought at Radio Shack (cat. no. 276-2501) for \$2.79 or less. You will also need a SPDT switch. I used one taken out of an old calculator. You can use an old one of your own, or buy one from Radio Shack (cat. no. 275-613) for \$1.79. I tried this Radio Shack switch in my computer and it works fine.

The next step is to open up your computer (an action that voids the warranty). Taking it apart is easy. Just be careful. Lay your computer, keyboard down, on a clean, spacious work area. Remove the black screws, noting

Figure 1 — Logic diagram of the modified circuit.



the position of each. Turn it over and take off the top piece.

Locate the wide cable at the lower left of the keyboard. Be *very careful* with this cable. It tends to fail when stretched or bent sharply. Carefully tilt the keyboard upright and remove the grommets beneath it. Being careful not to bend either board, lift the entire assembly out of the bottom plastic piece. Fold it open so that the keys of the keyboard and the components of the main board are on top. Rotate the assembly to make the keyboard closest to you and put it down on a flat surface.

Piggyback

Find Z45 on the main component board in the corner nearest the power LED. The "Z45" refers to the chip directly to the right. This is where you will piggyback the static RAM.

Take your static RAM and locate pins 11 and 12 (see Figure 2). *Carefully* bend these pins at their widest point so that they stick straight out to the side. Place your chip on top of Z45 with pin 1 closest to where "Z45" is printed. Press down enough on your chip to make the two chips touch. Except for pins 11 and 12, the pins on your chip should lightly touch the corresponding pins on Z45. If not, bend the pins on your chip inward slightly until they do.

Warm up your soldering iron of no more than 30 watts. Using thin, rosin-core solder, you are going to connect the matching pins (except 11 and 12) of Z45 and your piggyback chip. When soldering this, you should try to flow solder from the pins on your added chip to the solder at the base of the pins on Z45. Be careful not to overheat the chip with your soldering iron. Use sufficient solder,

but watch for solder bridges between the pins. If any solder bridges develop, use a solder wick to suck up the excess solder.

Find Z27 on the circuit board, just above Z45. This is the best place to make the trace cut shown in Figure 1. Locate pin 13 on Z27. The trace to be cut runs diagonally down and to the right from this pin (Photo 1). Be sure that you have the right trace before you start cutting. Using an X-acto knife or single-edged razor blade, cut the trace. Scrape deep enough to be certain that the connection is broken.

Figure 2 — Pin numbering for a 16-pin chip.

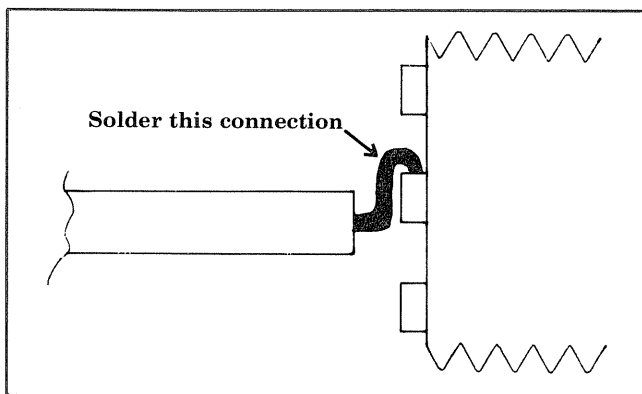
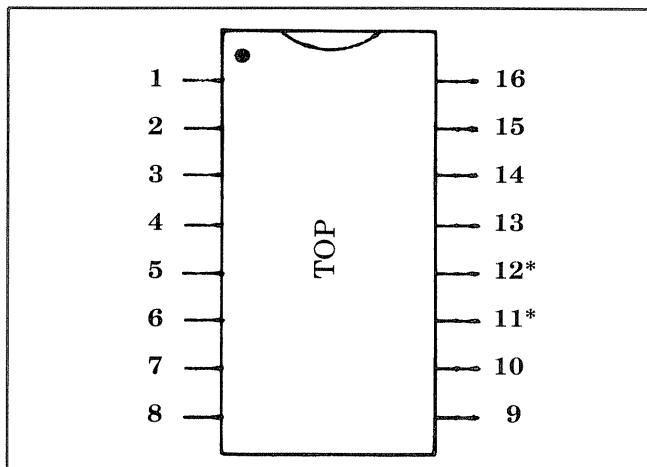


Figure 3 — The finished product of a hook-solder.

Wiring

Cut three pieces of one-conductor wire to 1.5 or 2 feet. Strip one-quarter inch of insulation from both ends of each piece. Using a pair of needle-nose pliers, bend one end of each wire into the shape of a hook. You are going to use this hook to attach the wire to an IC pin. Slip the hook around the pin you want and flow solder from the curved part of the wire to the pin and the solder at the base of the pin. Be sure the solder does not bridge to other pins. Then, bend the wire so that it's perpendicular to the chip (Figure 3).

You are going to hook-solder two of your wires. Connect one to pin 13 of Z30. (Note that this is a 14-pin

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chip.) Solder the other wire to pin 4 of Z60. This chip is under the ROM connect ribbon of Level II machines. Bend the stripped part of your last wire into a loop and solder it to the outstretched pin 12 on the piggyback chip.

Cut a two-inch piece of wire and strip both ends of it. Hook-solder one end to pin 5 on Z60. Loop the other end and solder it to pin 11 on the piggyback chip.

The Switch

Solder the wire connected to pin 4 of Z60 to the middle terminal of your SPDT switch. Take the two remaining long wires and solder them to either of the side terminals. The operation is now complete!

Now, for a place to put the switch. Although it can be anywhere, a convenient place is next to the break key, in line with the power LED hole. For the Radio Shack switch, simply drill a one-quarter-inch hole and insert the switch. Use the provided nuts to hold it in place.

Testing

Carefully put the computer back together, remembering to be gentle with the keyboard cable. When you turn your computer on, you should see either "MEMORY SIZE?" or a bunch of symbols that you have never seen on your computer before. If you see the symbols, flip the switch to get letters instead. If flipping the switch does not get you "MEMORY SIZE?", reopen your computer. Check the wiring and look for solder bridges. If the lowercase seems to work but the keyboard is giving you problems, replace the cable connecting your computer to the keyboard.

When you flip the switch back and forth, you will probably see reverse apostrophes flash on the screen. This is normal.

Driver 1

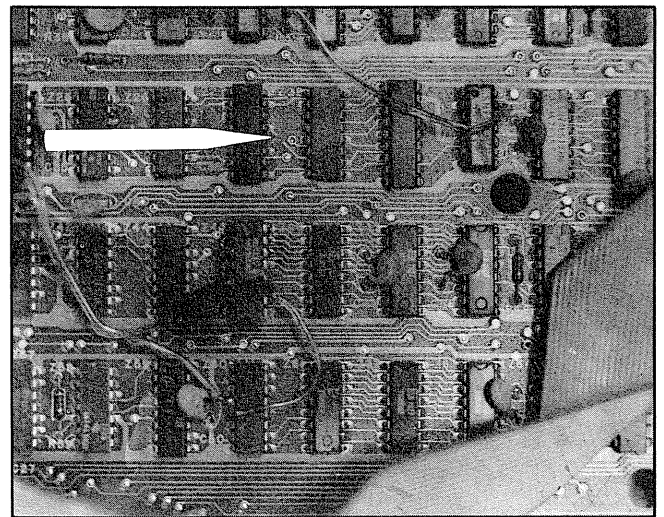
Although you may access lowercase by using the POKES of the testing program, it's a lot easier to use a special driver program. Listing 1 shows a program that can be assembled for use in computers without disks. As written, it will load into low memory and leave you with your normal amount of space for BASIC programs. For use in disk systems, change line 140 to make the driver routines reside in high memory.

The "Driver Plus" provides many features. It lets you toggle between shift for lowercase and shift for uppercase. This switch can be made by pressing shift, downarrow, and C at the same time. It can also be set by your programs. POKE 16408 with zero for shift for lowercase and with 255 for shift for uppercase.

A second feature this program has is access to the special symbols without using the POKE command. The CHR\$ values that are usually used for space compression codes have been altered. The codes from 192 to 223 will give you the special symbols. Run line 20, shown in photo 1, to test this feature. You should get the four display lines labeled 3. If you would rather have the space compression codes, delete line 270 and remove the carry condition in line 280 of Listing 1.

Two new symbols can be accessed from the keyboard. Shift @ will now be displayed as a reverse apostrophe. Hitting the uparrow in the shift for uppercase mode will

Photo 1—All wiring and the correct trace cut.



give you a left brace.

Driver 2

Listing 2 shows a BASIC driver for non-disk systems. The routine needs to be executed once by your programs for them to use lowercase. This program will give you shift for lowercase only and no modification of the CHR\$ command.

Final Comments

In some computers, the lowercase "a" is raised up. If this is true for you, you'll just have to learn to live with it.

I thought I would have trouble using lowercase in purchased machine language software. In some cases, the driver program is needed, but others (such as Big Five Software programs) will give you lowercase without the driver!

I think you will find this a simple, yet extremely useful, modification. I am sure you will get your money's worth from it.

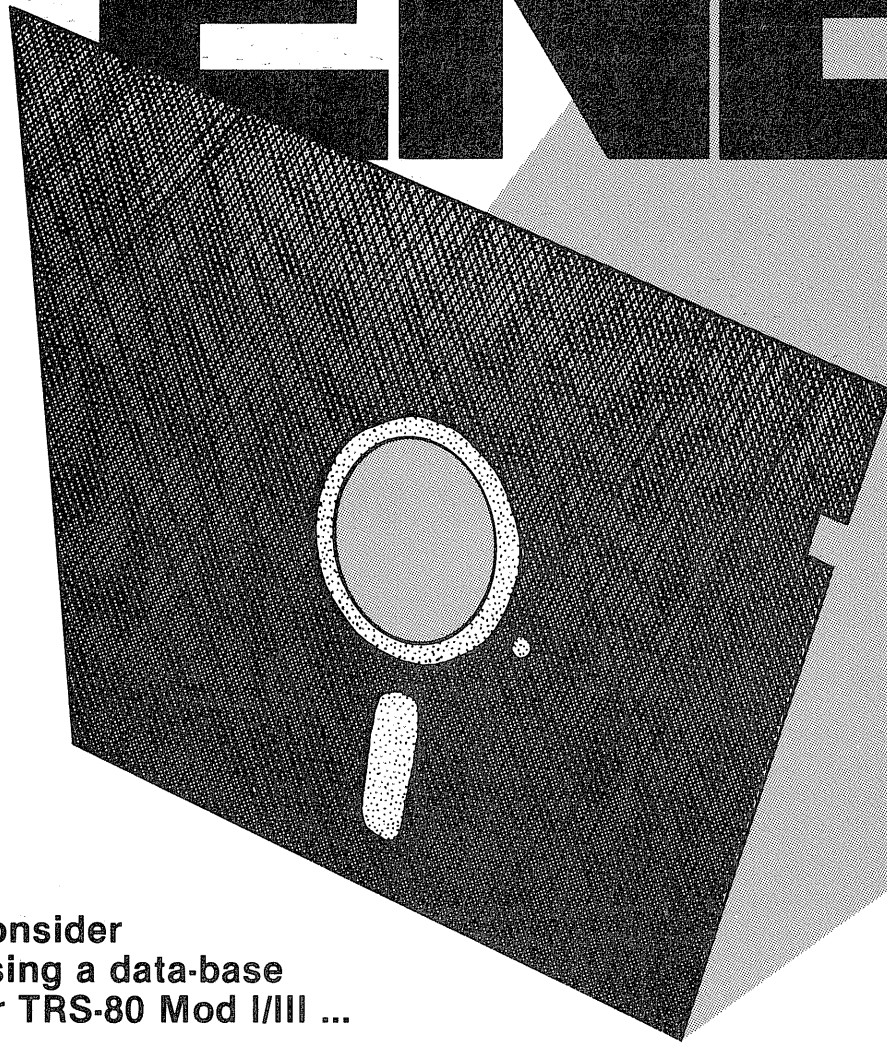
Listing 1 — Lowercase

```

00070 #LOWER CASE DRIVER PLUS
00080 #WRITTEN BY NEG COMPUTING FOR PUBLIC USE
4016      00100      ORG      4016H      #KEYBOARD DRIVER ADDRESS
4016 6240      00110      DEFW      KEYBRD  #CHANGE KEYBOARD DRIVER
4018      00120      DEFS      6          #SKIP TO VIDEO DRIVER
401E 3E40      00130      DEFW      VID      #CHANGE VIDEO DRIVER
403E      00140      ORG      403EH      #THIS CAN BE MOVED UP
403E D6E03     00150      VID      LD      L,(IX+3)  #HL = LOCATION ON SCREEN
4041 D6604     00160      LD      H,(IX+4)
4044 DA9A04    00170      JP      C,49AH
4047 D07E05    00180      LD      A,(IX+5)
404A B7        00190      OR      A
404B 2801      00200      JR      Z,CURROFF
404D 77        00210      LD      (HL),A
404E 79        00220      CURROFF LD      A,C
404F FE20      00230      CP      20H
4051 DA0605    00240      JP      C,506H
4054 FE80      00250      CP      80H
4056 3807      00260      JR      C,DONE
4058 FECC      00270      CP      192
405A DAA604    00280      JP      C,4A6H
405D D6C0      00290      SUB      192
405F C37D04    00300      DONE  JP      47D0H
4062 CDE303    00310      KEYBRD CALL  3E3H
4065 FE03      00320      CP      3
4067 211840    00330      LD      HL,4018H
406A 280E      00340      JR      Z,CONTC
406C 47        00350      LD      B,A
406D 7E        00360      LD      A,(HL)
406E B7        00370      OR      A
406F 78        00380      LD      A,B
4070 C9        00390      RET
4071 FE41      00400      CP      65
4073 D8        00410      RET      C
4074 FE60      00420      CP      96
4076 C8        00430      RET      Z
4077 EE20      00440      XOR      20H
4079 C9        00450      RET
407A 3EFF      00460      CONTC LD      A,255

```


ENB



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407C AE      00470      XOR      (HL)
407D 77      00480      LD       (HL),A
407E AF      00490      XOR      A
407F C9      00500      RET
00CC        00510      END      60CH
          :TOGGLE WITH 4018H
          :PUT RESULT IN 4018H
          :CLEAR A
          :RETURN TO ROM
          :BASIC ENTRY

```

Listing 2 — Lowercase

```

5 REM BASIC LOWERCASE DRIVER
6 REM WRITTEN BY KEG SOFTWARE FOR PUBLIC

```

USE

```

10 POKE 16414,62:POKE 16415,64
20 FORQ=16446TO16481:READW:POKEQ,W:NEXTQ
30 DATA 221,110,3,221,102,4,218,154,4,22
1,126,5,183,40,1,119,121,254,32,218,6,5,
254,128,56,7,254,192,218,166,4,214,192,1
95,125,4

```

Cassette mode switch

An easy-to-build cassette switch—get rid of the plug hassle

Models I/III

Russell A. Dewey, Ph.D., Statesboro, GA

Are you tired of unplugging your “ear” and “mic” plugs every time you want to find out where a cassette program begins? Would you like a convenient way to switch on an external speaker for games with audio routines? If so, you might want to construct the cassette mode switch box described in this article. It is cheap, a genuine convenience, and very easy to make, requiring no technical knowledge whatsoever.

There are three different modes in which your cassette player can be used. Even if you are a disk user (as I am) you will find yourself loading programs from tape, listening to a tape to locate the start of a program, or using your cassette for programs with audio routines. To switch between these modes, you must plug and unplug the three cords leading into your tape recorder.

CLOAD: When you load a program from tape, all three plugs from your computer must be in the tape recorder jacks.

MONITOR: When you need to find the beginning of a program on a tape, you must pull out the ear and mic plugs so you can run the tape recorder on play and hear what is on the tape.

AUDIO: To get sound from a program which provides it, you must pull out the ear plug and replace it with a plug leading to an extension speaker or earphones. You also must put a blank cassette or cassette shell without tape into the recorder and press the record and play buttons.

All that pushing and pulling of plugs is a hassle. In addition, it puts a strain on the cords which can wear them out, resulting in bad connections.

A simple box with two switches eliminates the need for plugging and unplugging. You can switch quickly and reliably between CLOAD, MONITOR and AUDIO modes. Necessary ingredients are available at your local Radio Shack store: Three (3) miniature phone jacks (cat. No. 274-253), one (1) subminiature phone jack (cat. no. 274-292), two (2) miniature phone plugs (cat. no. 274-2888), one (1) subminiature phone plug (cat. no. 274-291), one (1) black plastic box (cat. no. 270-230), and two (2) subminiature SPDT toggle switches (cat. no. 275-613).

The unit can be designed to plug directly into the cassette recorder, or as a “remote control” box with cords leading to the recorder. I chose to attach the box directly to the recorder because it looks neater. The only disadvantage to this approach is that you must cut the box so that it will fit flush with the jacks on the recorder and you must drill holes which line up exactly with the jacks on the recorder.

To assemble your mode switching box (if you decide to plug it directly into the recorder) first trim the box so it will fit into the recessed area containing the jacks on the recorder (Figure 1).

Mark and drill one-eighth-inch holes where the plugs will emerge from your box. This must be done carefully, with small test holes drilled first, so the holes line up perfectly with the jacks on the recorder. When you are sure the holes in the box line up with the holes on the recorder, enlarge the holes in the plastic box to the diameter of the threaded part of the plugs. On the plugs listed, this is about one-quarter-inch. If in doubt, make the hole too small. You can always enlarge it.

Install your plugs. The subminiature plug can be kept

in its tapered white plastic jacket, which fits snugly into the quarter-inch hole. The miniature plugs should have their metal jackets removed. The jackets are unnecessary inside the box and take up a lot of room. Replace the jackets with an appropriately-sized nut on the inside of the box. I used "Rad nuts," plastic nuts (available in most hardware stores) which adjust themselves to odd thread sizes.

Once the plugs are installed and tested for fit with your recorder, drill holes for the jacks on the other side. Drill three holes opposite the plugs, and drill a fourth hole somewhere for the external speaker jack. I located my speaker jack on the top of the unit (Figure 2) where it comes pretty close to the power cord. Now, drill two holes on top of the box, install your switches, and you are ready to solder the connections. Use small diameter, flexible, single-strand wire.

The wiring diagram assumes that you are looking at the bottom of the unit while it is upside-down for soldering. For example, plug "A" is the one which will eventually go into the ear jack on your recorder. It appears on the left in the diagram because we are

assuming the unit is turned upside down for soldering.

Assembly Procedure

References here are to the labels shown in Figure 2.

Solder a wire from the center terminal of subminiature plug C to the center of SPDT switch SW2.

Run a wire from the ground terminal of plug C through the bottom terminal of switch SW2 and on to the ground terminal of jack G. Solder all three places.

Solder a wire from the top terminal of switch SW2 to the hot (ungrounded) terminal of subminiature jack G.

Solder a wire from the ground terminal of plug B to the ground terminal of jack F.

Solder a wire from the hot terminal of plug B to the hot terminal of jack F.

Solder a wire from the hot terminal of plug B to the hot terminal of jack F.

Solder a wire from the hot terminal of plug A to the middle terminal of switch SW1.

Solder a wire from the ground terminal of plug A to the ground terminal of the external speaker jack D.

Solder a wire from the top terminal of switch SW1 to

Figure 1 — Cut off the shaded part so the plugs can fit flush with the jacks on the recorder.

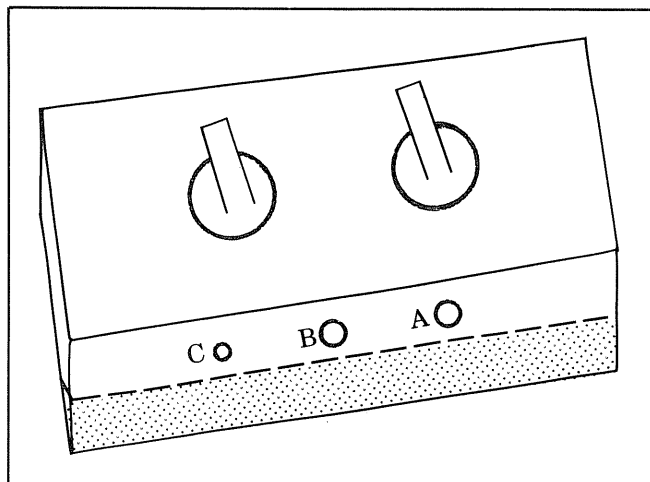


Photo 1 — Completed switch box.

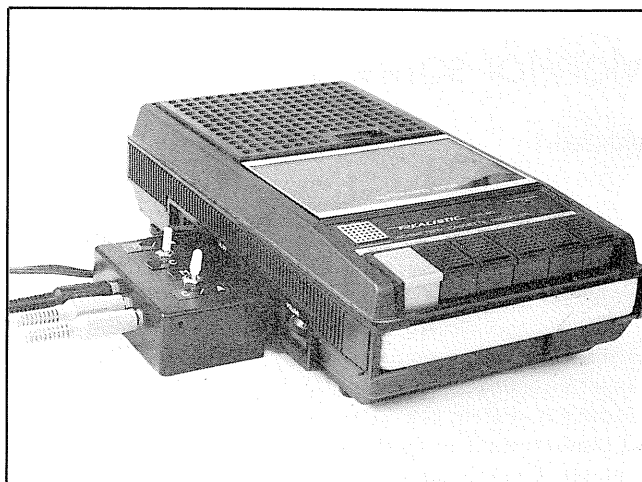


Figure 2 — Component parts labeled (inside view from the bottom).

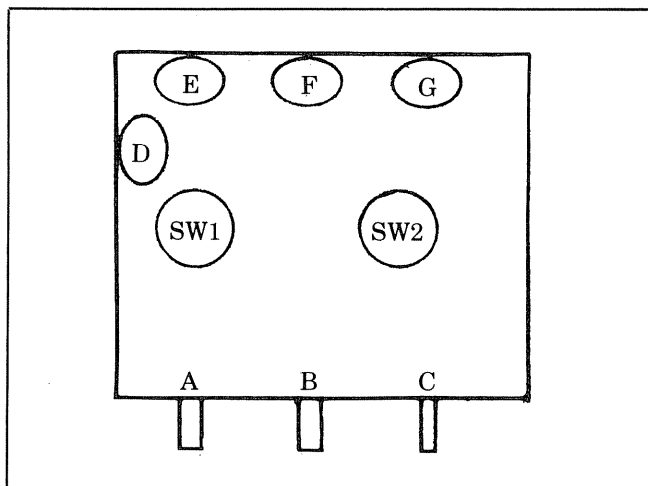
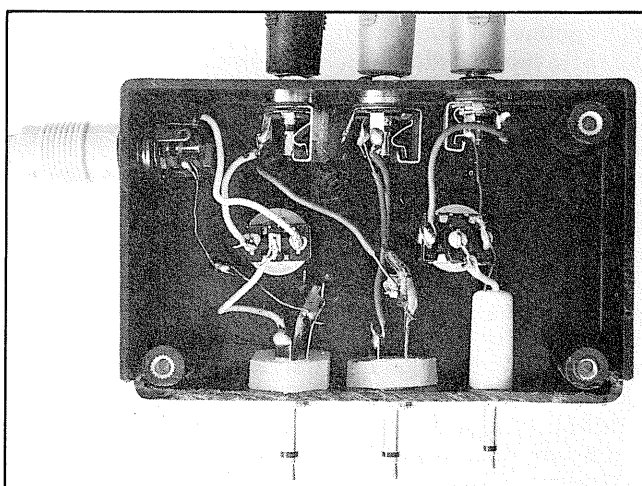


Photo 2 — View from the bottom. Notice the cutout plastic so it will fit flush on the recorder.



the hot terminal of miniature jack E.

Solder a wire from the bottom terminal of switch SW1 to the hot terminal of the external speaker jack D.

Solder a wire from the ground terminal of miniature jack E to the ground terminal of the middle miniature plug B. (This is the only part of the whole procedure which is counterintuitive. If you solder the ground lead from the jack to the ground terminal of the corresponding (top) miniature plug, you get feedback over the external speaker while in the audio mode.)

Now, put labels on top of the box. I positioned my

switches so that in the CLOAD mode both switches are down, in the MONITOR mode both switches are up, and in the AUDIO mode the bottom switch is down and the top switch is up. Correct settings are indicated by one-letter abbreviations on black label tape (Figure 2).

Once you have the box assembled, plug it into your recorder, plug in the three jacks from the keyboard, and plug in an external speaker (RS cat. no. 40-1247 is perfect), and you are ready to go. No more pulling plugs when you want to hear something from your TRS-80... just flip those switches and you're ready.

Electronic watchdog

Monitor sounds with your TRS-80

Model I

George Farnsworth, Reston, VA

Did you know that there is a watchdog inside your Model I?

Without any exotic wiring or expensive hardware, you can attach your computer to a sonic monitor, your cassette recorder, and to an audio alert, your hi-fi set, to produce a system that detects an intrusion and sounds-off loud enough to frighten almost any burglar. Nor is that all. The system also has features not found in any but the most advanced commercial systems. And, all of this in less than 1,000 bytes and only 13 lines of BASIC.

The TRS-80 sits quietly in your empty house or apartment, using the cassette recorder's built-in microphone to listen carefully for any sound. Sound in the room might indicate an attempt to break in, or that someone is already there. When the computer detects a sound, it sends an audio signal to your stereo, which then amplifies it into an ear-shattering alarm. The program also displays a message designed to further frighten an intruder, if he or she gets close enough to read the screen.

After sounding the alarm for two minutes, it goes back to the listening mode. The program keeps a record of the number of times the alarm was activated so that when you get back home you'll know whether to count the spoons or not. A brief time delay is provided between the detection of a noise and the alarm. This allows you to deactivate the system when you get home (press BREAK).

Listing 1 contains the source code with a standard machine language sound-generator routine embedded in a DATA statement. This code is placed in a string in statement 100 and the string's address is POKED into the location required by the USR function.

Lines 30 and 40 set up the screen and go into "listening" mode. When a sound is detected through the cassette port via INP(255), statement 40 transfers control to the "alarm" routine in lines 60 through 80. After a brief interval set by variable WT (in seconds), the alarm sounds. The sound can be changed by setting different values for variable SS. With SS at zero and AT (the number of alarm cycles) set to 100, you get a nice, loud, two minutes of a "whoop" alarm. The sound produced by SS=11111 is much shorter however, and AT must be set much higher to get a long alarm.

Setting up the recorder is simple. The black plug goes into the cassette "EAR" jack as usual. Do not use the small, gray, motor-control plug. Remove any cassette and hold your finger inside the mechanism where the left rear of the cassette would normally go. There's a small lever there that you have to hold back while pushing down the "RECORD" and "PLAY" keys simultaneously. There is no danger to your finger. This process will start the cassette motor running and you can then remove your finger.

For the audio alarm, the large gray plug has to be input to your stereo, via the microphone, "AUX", or "TAPE" jacks. You will probably need an inexpensive

adapter plug or cord if your stereo does not accept a mini-plug. Ask for a cord with a mini female at one end and an RCA male at the other. Turn on your stereo, set the selector to Aux or Tape, as the case may be, and you're in business. Start out at very low volume and experiment until you get a sound loud enough to scare an intruder without damaging a speaker. The cassette volume control has no effect.

When using the alarm you should eliminate the possibility of stray sounds in the vicinity of the microphone, such as that from pets or telephones. You should also alert neighbors to the fact that your computer is on guard and ask them to react to a blast of sound, either by investigating or by calling the police. Let them know that the system will shut the alarm off after a few minutes, but that it does not mean that the intruder has necessarily gone. Advise them not to tap on your windows or rattle the door, since the noise may set off the alarm.

The system could be enhanced in several ways. You could connect a more sensitive microphone (or a set of microphones) through a pre-amplifier. This would also avoid your having to keep the cassette motor running for several days. The stereo could be replaced by an inexpensive PA amplifier with a weatherproof speaker installed outside. Users with a real-time clock could easily add a routine to stop listening during the day if external noise is a problem. You can leave the video

monitor off and save a little electricity, but I relish the thought of a clumsy burglar thinking that a computer is watching.

Although the bare-bones system is not exceptionally sensitive, at the very least this system will help protect your TRS-80, your stereo, and maybe your life!

Listing 1 — Sound Monitor

```

10 DEFINT A-Z: CLEAR 1000: GOSUB 100 : SS=0: W
T=300: AT=20: B$=CHR$(23)
20 '===== LISTENER ROUTINE =
=====
30 CLS: PRINT@514, B$; "INTRUDER WATCH IN
EFFECT": PRINT@960, AC;
40 OUT 255, 8: S=INP(255): IF S<>63 THEN 60
ELSE 40
50 '===== ALARM ROUTINE =====
=====
60 CLS: PRINT@322, B$; "!!! INTRUDER ALER
T !!!": PRINT@454, "AUTHORITIES NOTIFIED"
: PRINT@656, "STAND BY": PRINT@960, AC;
70 FOR IQ=1 TO WT: PRINT@0, WT-IQ; : NEXT: PR
INT@0, " "; : AC=AC+1
80 FOR IQ = 1 TO AT: PRINT@656, "
"; : X=USR(SS): PRINT@656, "STAND BY"; : X=USR

```

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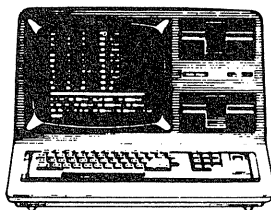
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```
(SS):NEXT: GOTO 30 : 'RESET
90 ===== SET UP SOUND GENER
ATOR =====
100 FOR K=1 TO 28:READ X:TT=TT+X:A$=A$+C
HR$(X):NEXT:X=FRE(A$):I=VARPTR(A$):IF TT
<>3424 THEN PRINT"DATA STMT ERROR":STOP
```

```
110 S1=PEEK(I+1):S2=PEEK(I+2):POKE16526,
S1:POKE16527,S2
120 DATA 205,127,10,77,68,62,9,105,211,2
55,45,32,253,60,105,211,255,45,32,253,13
,16,238,62,8,211,255,201
130 RETURN
```

A simple sensor input for Model I

A simple sensor input switch

Model I

Michael L. Sanders, Eatontown, NJ

Could you use a simple, inexpensive remote sensor input for your Model I? With this easily-installed modification to your keyboard, you can have an input that has automatic debounce and is simple to program. All that is required is that you solder a pair of wires to any key position and connect it to a switch or relay. The ROM's keyboard scan does the rest. By using the INKEY\$ command in your program, you can detect when the switch or relay is closed.

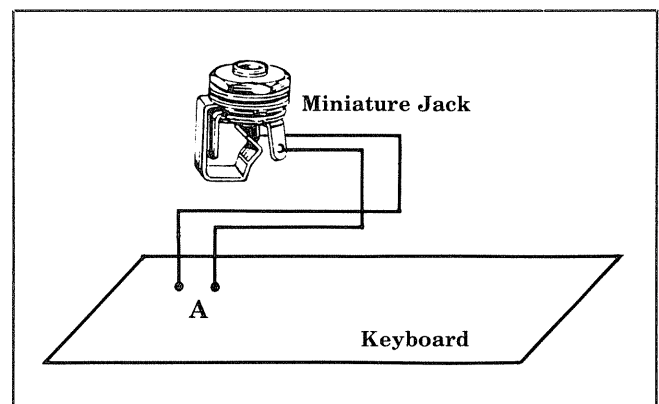
Installation

Figure 1 gives a physical view of the modification, and Figure 2 gives the schematic view. Prepare the ends of about one foot of twin lead wire, such as that used by the small earphone for a transistor radio, by stripping about one eighth of an inch of insulation from each of the four wires and tin them with solder. Disconnect the keyboard from all external connections. Turn the keyboard upside down on a towel. Remove the screws holding the two halves of the case together. Hold the case together and turn it right side up. Remove the top half of the case. Gently lift the top circuit board up and forward. Do not strain the cable at the lower left connecting the two circuit boards together. Rest the top circuit board on a stack of towels, key side down.

Looking down on the circuit board, you can see the keys labeled. By each character, there are two solder connections. These connect the key switch to the circuit board. Solder one end of each of the two wire pairs to these solder connections. Examine the soldered connections for solder bridges and shorts.

Solder the other two ends of the wire pair to the miniature jack. Drill a hole in the top half of the case on

Figure 1 — Physical connection.



the rear, flat portion above the cooling slots. Mount the jack in the hole.

Gently lift the circuit board on the towel and carefully fold it back into place. Replace the top half of the case. Be careful that the LED power indicator goes into the hole on the top half of the case and that no wires are being pinched by the case. Hold the case together and turn the keyboard over. Replace the screws. Replace all external cables and turn the computer on to insure proper operation.

Hook-up

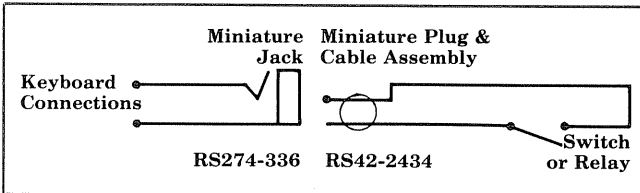
Use a cable with a miniature plug on one end (RS cat. no. 42-2434 will do) and a switch or relay on the other end. Although the keyboard is buffered, it is best to keep the leads under six feet. For longer leads, use a relay as

in Figure 3.

Now, you are able to program with INKEY\$ just as if you were looking for the key that is paralleled by the external switch. This is an example:

```
10 GOSUB 100: REM CALLS THE SENSOR STATUS
    SUBROUTINE
20 IF FLAG = 1 THEN 40: REM ROUTES PROGRAM
    ACCORDING TO SENSOR STATUS
```

Figure 2 — Schematic connection.

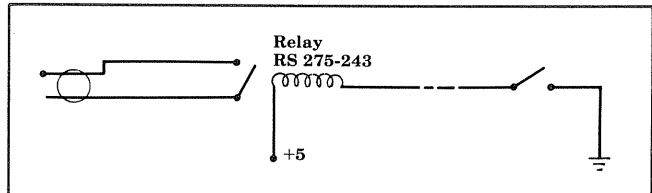


```
100 FLAG = 0: A$ = INKEY$: REM RESET FLAG
    AND READ KEYBOARD
200 IF A$ = "A" THEN FLAG = 1: REM SET FLAG IF
    SWITCH IS CLOSED
130 RETURN: REM RETURN TO MAIN PROGRAM
    WITH VALUE OF FLAG
```

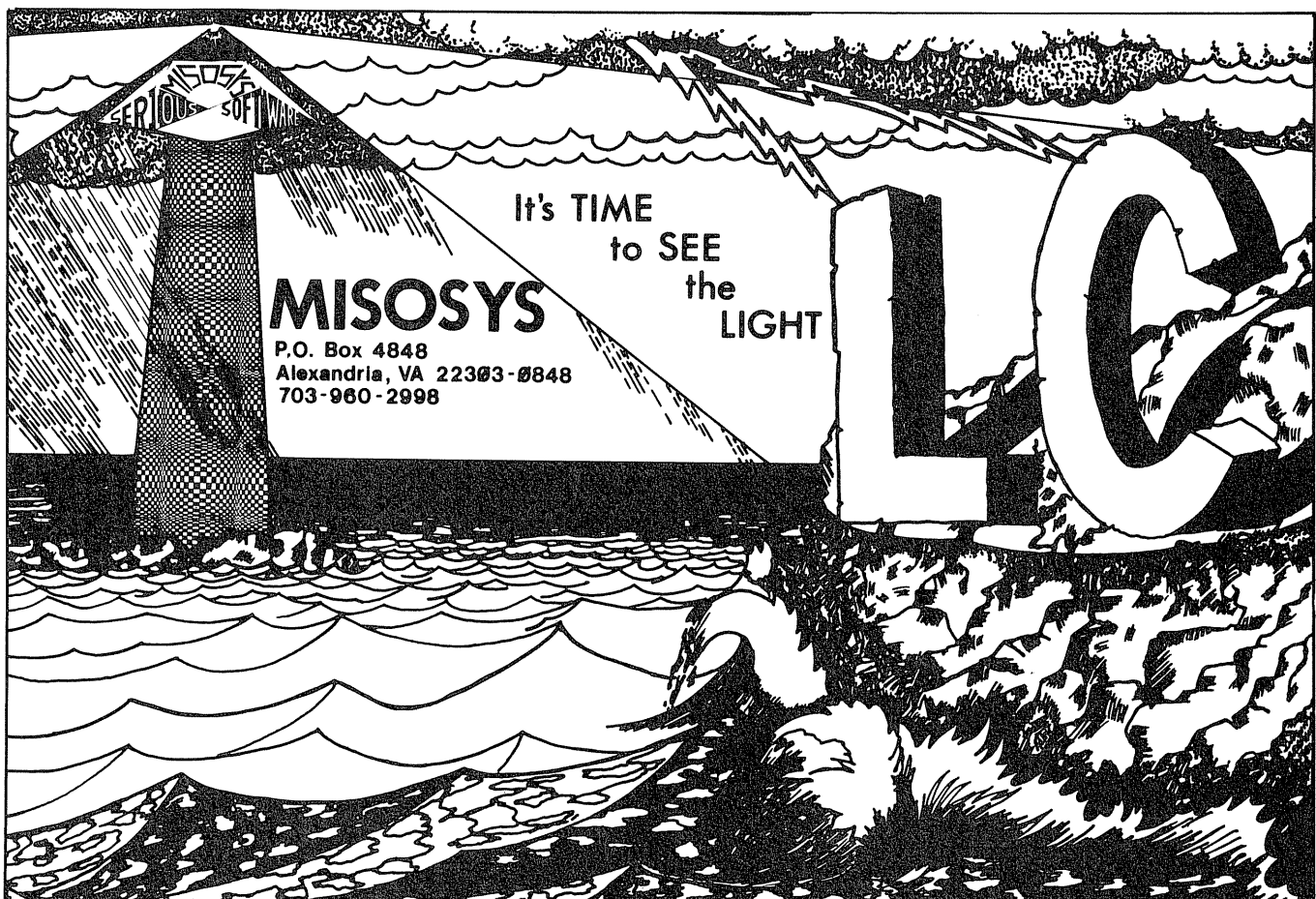
While running the program, the keyboard cannot be used by the operator since the ROM uses a routine to choose only one character when more than one key is pressed at a time (which will happen if the sensor switch is closed).

This simple sensor input can be convenient to use in experiments when an external event is timed or monitored. Obviously, each key is a potential input, but

Figure 3 — To extend the length of cable, use a relay.



the programming to decode them would become more complicated. Since the keyboard is memory-mapped, each memory location used would have to be PEEKed and the number obtained converted to binary to find the state of each switch. By using only one input, you can easily begin to learn to use your computer as more than just a "number cruncher." This allows your computer to at least touch the real world.



A computer language board

Meeting the educational needs of handicapped students

Model I/III with 3G light pen

Terry Dalton, Yuma, AZ

The schools are now required to meet the educational needs of all students, even those with severe handicaps. In our school district, many children have suddenly been able to communicate, to learn, to feel the pride of accomplishment that goes along with computer aided instruction. Some, however, cannot control that needed finger enough to press an individual key and their only form of intelligible communication has been with a language board.

A language board is simply a box about two feet square and six inches thick. There is a checkerboard face with LEDs in each square that light, one at a time, when controlled by pressure switches. Hands, feet, arms, fingers, even the mouth, can control the LED. Overlays with printed words fit on the board face and a washable overlay is available for customizing the vocabulary. It is simply constructed, expensively priced,

and in many cases too frustrating to learn to operate.

My computerized language board has three pages of eleven words, is easily expandable and changed, uses the 3G light pen, and all of this for under \$40, the price of the pen. (*The 3G light pen for the TRS-80 Model I/III is available from the 3G Company, Inc., Rt 3 Box 28A, Gaston, OR 97119, (503) 662-4492. --Ed.*)

Students using the pen and the program can choose the word to be printed, up to two lines of them, and can cause the entire two lines to dump to the printer. Disk files could be utilized to store alternate pages, or you could even turn the basic concept into a word processor.

This program is just a starting point. Our students need programs that teach them the very basics, comparisons, recognition, etc. Older students or adults would need other enhancements, depending on their needs. A light-pen-controlled BASIC programming

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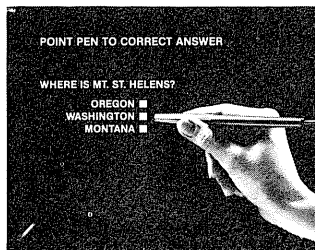
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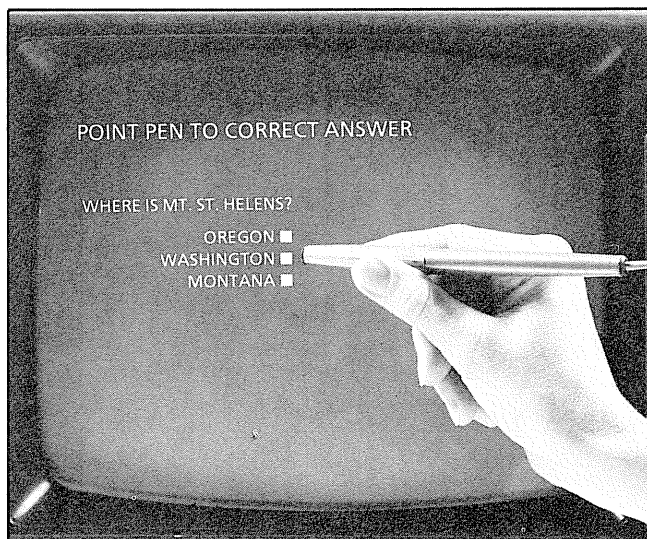
- "The teachers in our district use the pen to score and record test results. It's so much easier than typing in the results." Phillip Diazlo, Mohawk Regional School Dist MA

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system is not that difficult to develop. That is why I wrote this program. To show myself and those teachers who work with our severely handicapped students that it can be done. The light pen is more than just another toy.

Program Listing for Computer Language Board

10 'COMPUTER LANGUAGE BOARD
20 '(C) 1982 BY TERRY DALTON
30 '1233 W. 16TH PLACE


```

40 'YUMA, AZ 85364
50 '(602)783-1765
60 'CREATED FOR THE 3G LIGHTPEN
70 '3G COMPANY, INC.

```

```

80 'RT.3, BOX 28A
90 'GASTON, OREGON 97119

```

```

100 '(503)662-4492
110 CLS

```

```

120 PRINT@512,"          COMPUTER LANGUAGE
BOARD FOR THE 3G LIGHT PEN":PRINT:PRINT
"(C) 1982 by Terry Dalton / 1233 W. 16
th Place / Yuma, AZ 85364":PRINT:PRINT"P
ermission to copy and modify is granted
to/for the handicapped.":FORI=1TO2000:NE
XTI:CLS

```

```

130 CLEAR1000

```

```

140 K=640:'POSITION WORD OUTPUT

```

```

150 DIMA$(16),C(16)

```

```

160 'CURSOR DEFINED

```

```

170 C$=CHR$(191)+CHR$(191)

```

```

180 'BLANK DEFINED

```

```

190 B$=" "

```

```

200 'NUMBER OF CURSORS

```

```

210 N=16

```

```

220 'ACTIVATE LIGHT PEN

```

```

230 OUT255,4:'MODEL I

```

```

240 OUT236,2:'MODEL III

```

```

250 PRINT@832,"HOLD LIGHTPEN ON THE CURS
OR IN FRONT OF THE WORD YOU WANT.":PRINT
"----- COMMANDS -----"

```

```

260 'READ FIRST PAGE OF WORDS

```

```

270 FORI=1TON:READA$(I):NEXTI

```

```

280 'POSITION CURSORS

```

```

290 FORI=1TON

```

```

300 READL

```

```

310 C(I)=L

```

```

320 NEXTI

```

```

330 'PRINT SCREEN

```

```

340 FORI=1TON:PRINT@C(I),C$;" ";A$(I);:N
EXTI

```

```

350 GOSUB370

```

```

360 GOTO260

```

```

370 ' RESET FLIP-FLOP

```

```

380 OUT255,4

```

```

390 ' LIGHT DETECTED?

```

```

400 IFINP(255)<128THEN400

```

```

410 'WHICH CURSOR?

```

```

420 FORP=1TON

```

```

430 FORI=1TO2

```

```

440 'TURN OFF CURSOR AND CHECK

```

```

450 PRINT@C(P),B$;

```

```

460 FORJ=1TO5:NEXTJ

```

```

470 OUT255,4

```

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```

480 FORJ=1TO5:NEXTJ
490 IFINP(255)>128THEN600
500 'TURN ON CURSOR AND CHECK
510 PRINT@C(P),C$;
520 FORJ=1TO5:NEXTJ
530 IFINP(255)<128THEN600
540 NEXTI
550 I=P
560 GOSUB720
570 IFA$(I)="ERASE"THENK=640:GOTO600
580 PRINT@K,A$(I);
590 K=K+(1+(LEN(A$(I))))
600 NEXTP
610 GOTO340
620 'PAGE ONE
630 DATAI,WE,YOU,THEY,HE,SHE,IT,ARE,AM,H
IM,HER,".",QUIT,NEXT,PRINT,ERASE
640 DATA64,80,96,112,192,208,224,240,320
,336,352,368,960,976,992,1008
650 'PAGE TWO
660 DATAWANT,NEED,WATER,FOOD,BATHROOM,BL
ANKET,CLOTHES,SHOES,COLD,HOT,HELP,".",Q
UIT,NEXT,PRINT,ERASE
670 DATA64,80,96,112,192,208,224,240,320
,336,352,368,960,976,992,1008
680 'PAGE THREE
690 DATAME,GET,READ,WILL,WAS,WHEN,WHY, W

```

```

HAT,WHO,HOW,THERE,".",QUIT,FIRST,PRINT,
ERASE
700 DATA64,80,96,112,192,208,224,240,320
,336,352,368,960,976,992,1008
710 END
720 'COMMAND ROUTINES
730 IFA$(I)="NEXT"THENGOSUB800 :GOTO270

740 IFA$(I)="FIRST"THENRESTORE:GOSUB800
:PRINT@979," ";:GOTO270
750 IFA$(I)="QUIT"THENCLS:END
760 IFA$(I)="PRINT"THENGOSUB830 :RESTOR
E:GOTO110
770 IFA$(I)="ERASE"THENPRINT@640,"

"

780 RETURN
790 'MAKE SPACE FOR NEXT PAGE OF WORDS
800 FORI=1TO12:PRINT@C(I),"
";:NEXTI
810 RETURN
820 'DUMP UP TO TWO LINES OF TEXT TO PRI
NTER
830 FORA=16000TO16120STEP64:FORB=ATO+64
:LPRINTCHR$(PEEK(B));:NEXTB:NEXTA:LPRINT
840 RETURN

```

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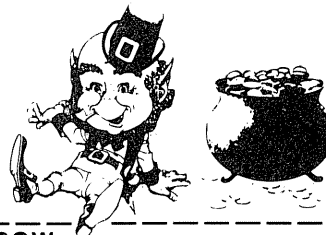
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Money saving hints

Low-cost expansion cover or printer stand

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Fraser Smithson, West Bloomfield, MI

Expansion interface cover



After I purchased a Micromint Disk-80 expansion interface, I was unhappy with their planned location for this unit to the left of the Model I CPU. I decided that if I could find a suitable cover, I could set the interface under the monitor as in a normal Radio Shack arrangement. Covers for this purpose are available, but being frugal by nature, I felt they were too expensive. A little searching led to a perfect solution.

K-Mart carries a plastic box made by M-K Products called a Sweater and Utility Box (#55-20), which sells for \$2.56. I removed and discarded the top, cut a 3" x 10" cutout on one of the long sides using a sharp knife and a straightedge. One must work carefully so as to not crack the box.

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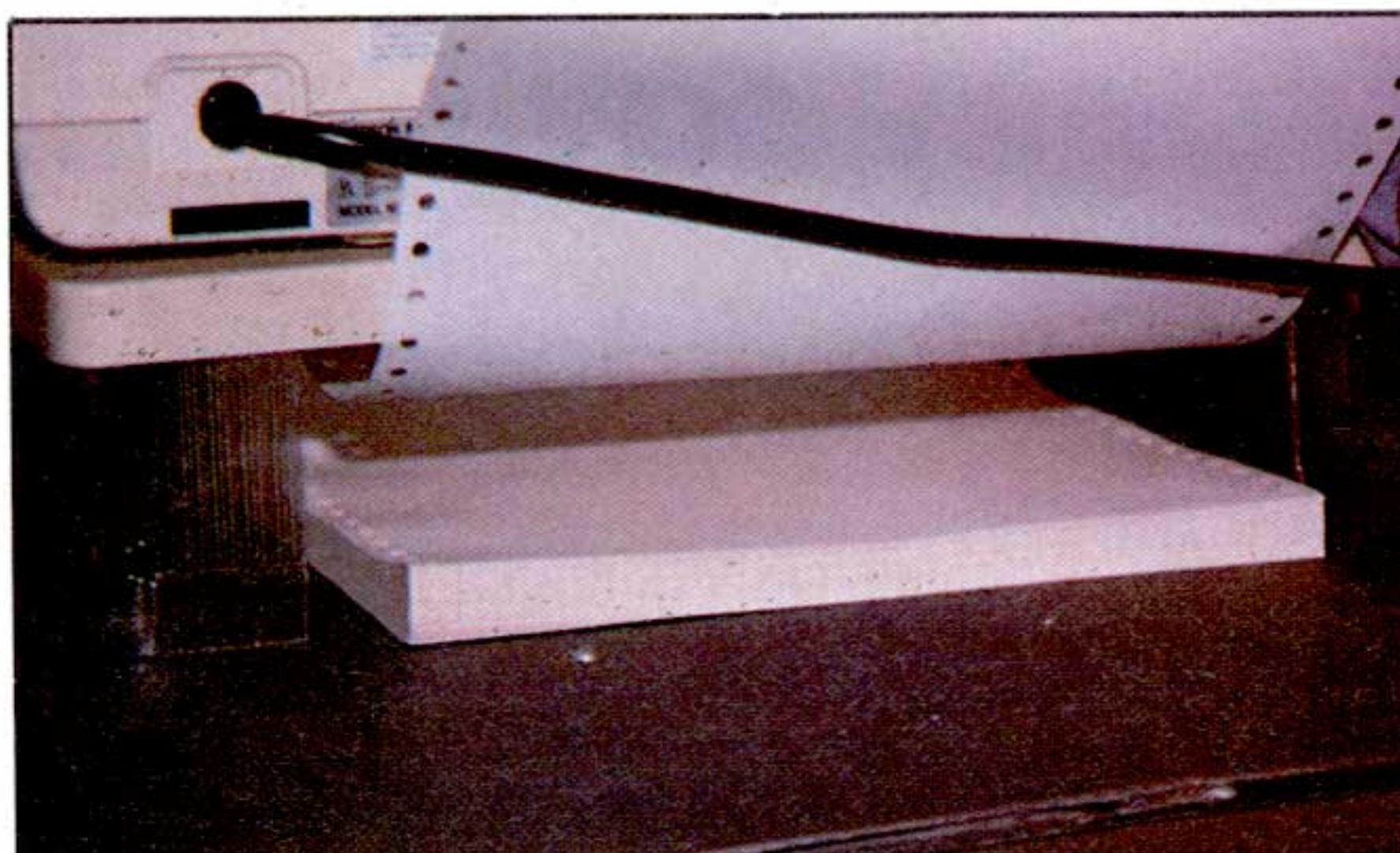
16727 Patton Detroit MI 48219

Next, I took a flat file and filed a notch $1/16$ " deep by $2\frac{1}{4}$ " on the opposite side top edge so that when it is placed face down over the Disk-80, the cable to CPU fit through without hitting the cover. The notch must start about 1" from the edge. One could also add notches for other peripherals if so desired.

I spray painted the exterior of the box with Krylon #1403 dull aluminum enamel. This paint, while not perfect, is a pretty good match to the Radio Shack silver gray. When it dried, I placed the box face down over the Disk-80 after having hooked up all of the cables. I had to put a twist in the cable to the CPU so that it hooked up properly. Next, I set the monitor on top of the box and, voila, I have a very neat arrangement at a total cost of \$5.23 including paint (which I hardly used at all).

The sweater box looked so neat that I purchased a second one and cut out a $3\frac{1}{4}$ " \times $10\frac{1}{2}$ " cutout on one of the long sides starting 1" from the left end. I placed it face down, put the cover on the bottom and I had a first class printer stand for my Epson MX-80. The paper stores neatly under the box and since the box is clear, you can

Printer stand showing cutout



easily see the quantity of paper remaining. Most printer stands of this type are \$20 to \$30. I figure that my frugality has saved me upwards of \$40, which I can spend on other goodies.

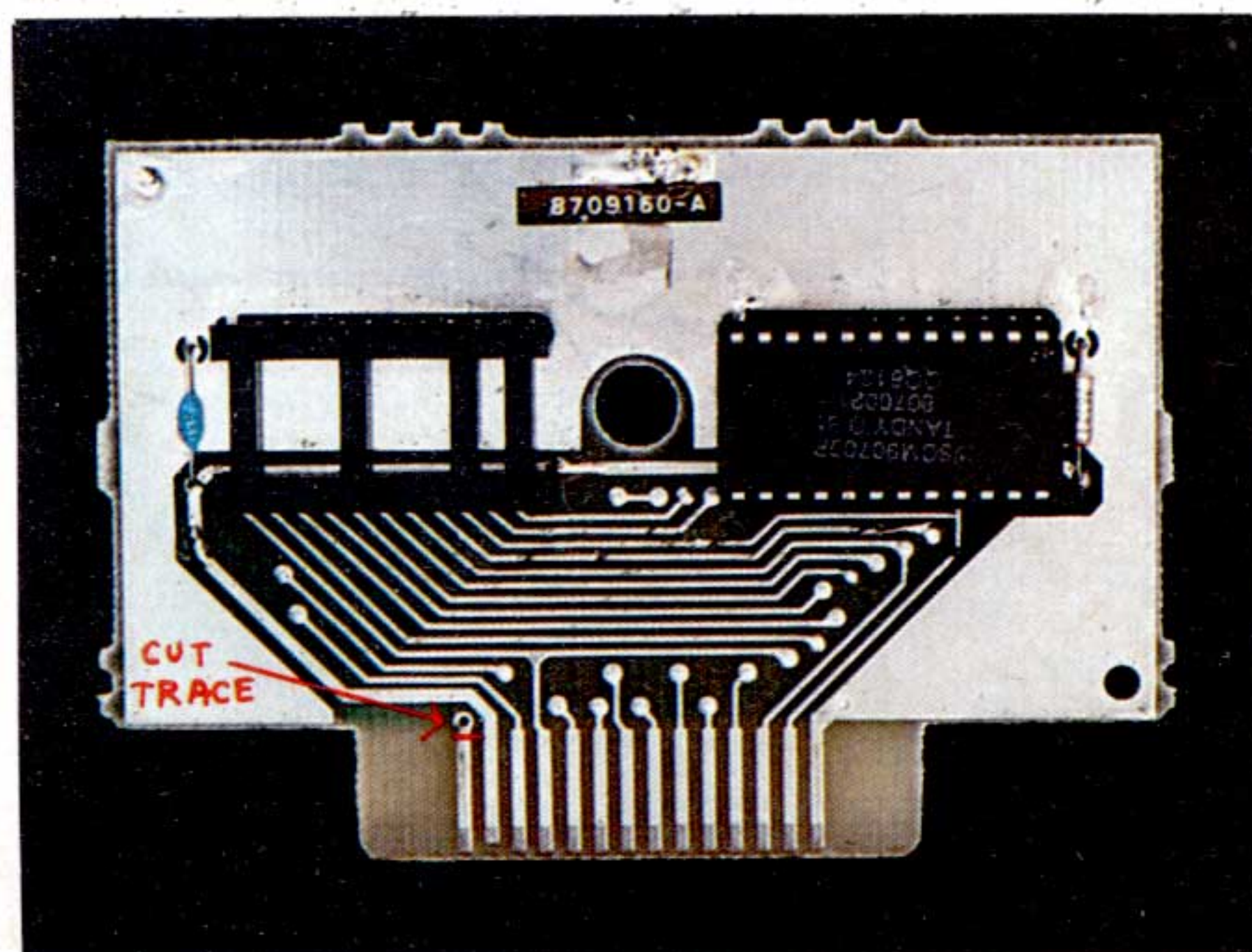
ROM remedies

Fix your ROM paks so you never lose BASIC

Color Computer

Robert Grater, Santa Clara, CA

Figure 1 — Shows the inside of the ROM Pack and indicates the single trace to be cut.



The Radio Shack Color Computer is a very powerful computing package for its size. When teamed with a Line Printer VII and Color Scretsit it becomes a great word processor.

One of the bothers with using the ROM Pack cartridges, such as Scretsit, is that, to prevent possible cartridge ROM damage, the computer has to be turned off before insertion or removal of the cartridge. This causes some extra steps if you write a BASIC program to, say, address a letter you intend to write with Scretsit. Well, there is a way around all this!

I had written a program to pre-address the first sheet on fanfold paper with the address and fold markers so it could be folded and inserted in a standard window envelope with the address showing through. This allowed me to start my letter using Scretsit on the next sheet, and when done, fold them all along the markers

and drop it in the envelope. Presto, no separate envelope to address.

The problem in using this pre-address program was that I would have to load it from tape, run it, print on the first sheet, turn the computer off, install the Scripsit ROM Pack, and then type my letter. Well, a Phillips screwdriver, sharp knife, and a little effort changed all that.

The cartridges for the Color Computer tie together two pins on the edge connector. The pins provide the path for the signal that tells the processor to boot the system from the ROM Pack and not from the standard starting address for BASIC. This line is easy to cut (that's what the knife is for), and once cut, the system will come up in BASIC even though the cartridge is installed. To execute the ROM Pack program, you type in EXEC 49152 and it will jump to the ROM Pack. This command tells the computer to execute the first instruction at decimal address 49152, which is the starting address for a ROM Pack program. If you are in a ROM Pack program, such as Scripsit, and want to get back to BASIC, simply press the reset button. But, be sure to first save anything important on tape since Scripsit will reinitialize and all your data will be lost. Now you have the option to use the ROM Pack or not, without turning off the computer to take it out, or re-insert it. Also, in a BASIC program the last statement can be an EXEC 49152 which will automatically jump you into the ROM Pack.

The ROM Packs are not that much a problem to take

apart, one screw holds the whole thing together. Once apart, they are not that delicate and you should have no problems. The single retaining screw can be felt through the label and removed with a Phillips screwdriver. The top half of the cartridge can be folded back, using the label as a hinge, or removed completely by cutting the label at the junction of the two cartridge halves. Inside the cartridge you will find a printed circuit board with an edge connector and a soldered-on ROM chip. The bottom half of the cartridge also contains a sliding cover for the edge connector and a spring to hold it in place. Don't worry if it comes completely apart, they are easy to get back together.

Figure 1 shows the inside of the ROM Pack; no further disassembly is needed. With the edge connector facing you, and the ROM chip up, you will note that the last "finger" on the right of the edge connector goes to the large area of the pc-board plating. It is the signal ground. The connection we want is the "finger" at the opposite end of the connector, the last one on the left. This "finger" runs to a small eyelet and through the board to the "finger" on the bottom side of the board. Using the knife, cut the trace, making sure that there is no metal left in the cut that could make a connection. Now, snap the cartridge back together, tighten the screw, and you are done.

This operation is so simple that I have done it to all of my ROM Packs. It is a lot easier to type in nine characters than to shut down and power-up the computer.

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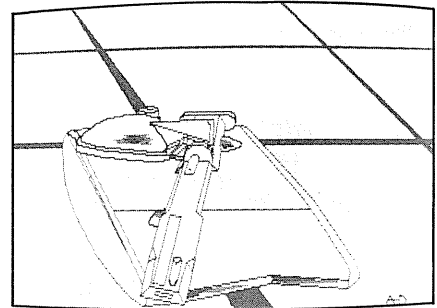
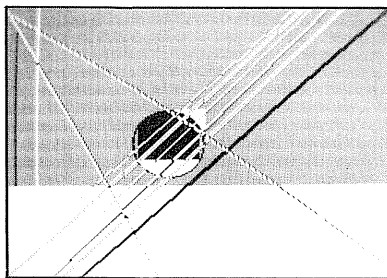


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Typos

Scan your programs for bugs before running them

Models I/III

Robert Pollock, San Francisco, CA

A bug in a program will remain undetected by your TRS-80 until it tries to execute it. I type in enough programs badly enough to often find a program crashing hours or days after I started using it. If you've ever spent tedious hours entering data, or been on the verge of defeating the necromancer only to be unfeeling informed of a syntax error, you know frustration.

This program can help. It actively searches BASIC programs for errors. If you leave out the colon between NEXT and RETURN, drop a parenthesis, or order the computer to PLINT, TYPOS will catch it. It works with the formal qualities of statements, not their sense, so some typos will escape it, as will logical or structural

mistakes.

Listing 1 is TYPOS. It is about 850 bytes long and doesn't require much overhead. It is used for keyboard work. ENTER GOTO65432. The program will ask where to start checking. It passes over lower numbered lines, then begins. It stops when it reaches a line numbered 65000 or greater. If it finds an error, it will inform you, finish checking the present line and then break. You can correct the error(s) on the spot, ENTER GOTO65432 and take up where you left off or just CONT.

TYPOS is slow. It takes about 45 seconds to skip to the 150th line of a program. A 12K-byte program with 150 lines and no remarks takes about 35 minutes to check.

Listing 2, PTYPOS, is a set of alternate lines for TYPOS that directs the output to a line printer. The printer option doesn't stop until it reaches a line greater than 64999. TYPOS and PTYPOS can be merged when and how the user desires. Cassette users who don't use merging techniques can create two programs and load their choice before entering their programs. The printer option is even shorter than the keyboard option, about 800 bytes total.

Line 65452 is the PEEK value subroutine. It returns the value stored at an address or computes and returns the value stored at a pair of addresses, depending on the value of UH.

The rest of the program is a rather simple-minded sieve. A look at the internal codes for BASIC keywords will make most of the program clear. One or two points might seem momentarily obscure. A line is one or more statements. Statements are separated by colons and statements, with one exception, need a command (: is acceptable, but I don't count it as a statement). A statement containing only a function, PEEK(A) or STEP-1, is defective, as are most statements containing two commands.

More specific considerations are: 16548 and 16549 contain the address of the first BASIC line, the first two bytes of a line contain the address of the next line, the next two bytes contain the line number of that line, a value of zero is placed at the end of every line but the last. Again, ELSE puts a colon before itself, TAB absorbs the



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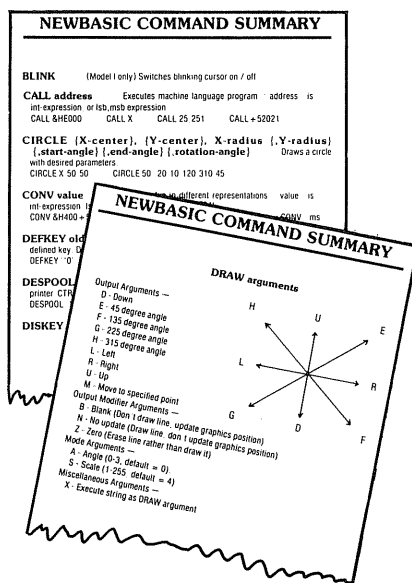
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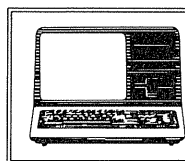
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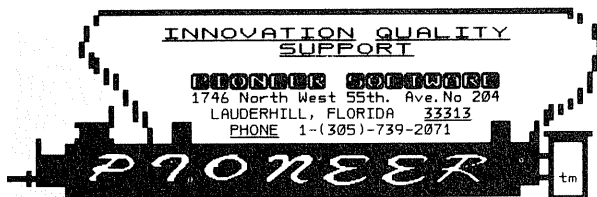
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following open parenthesis, REM and a quote stop analysis of input and the code for END is 128.

The use of these few simple ideas can't produce a miracle cure for bugs, but if you do much work at the keyboard, I think you'll find TYPOS well worth using.

Listing 1 - TYPOS

```
65430 PRINT"END":END
65432 CLEAR3:DEFINTU:UB=0:OB=0:UC=0:UD=0
:UE=0:UF=0:UG=0:UI=0:OC=16548:UH=1:GOSUB
65452:OA=OB:CLS:INPUT"BEGIN LINE":OD
65434 OC=OA+2:GOSUB65452:IFOB<ODTHENOC=O
A:GOSUB65452:OA=OB:GOTO65434ELSEIFOB>649
99GOTO65430ELSECLS:PRINT"WORKING ON LINE
"OB:UA=4:PRINT"STATEMENT/TYPE":OC=OA+4:U
H=0:GOSUB65452:IFOB=58UA=5
65436 OC=OA+UA:UH=0:GOSUB65452:UB=OB:UA=
UA+1:IFUF=3ANDUB<>58ANDUB<>0ORUC=LANDUB<
>0GOTO65436ELSEIFUB=129ORUB=140ORUB=1430
RUB=149ORUB=156ORUB=158ORUB=161ORUB=1710
RUB=172ORUB=176ORUB=213UF=2:GOTO65436
65438 IFUB=136UF=3:GOTO65436ELSEIFUB=34U
C=UC+1:IFUC=2UC=0
65440 IFUB>127ANDUB<188ORUB=199IFUF=1UI=
1ELSEUF=1:IFUB=147UB=0
65442 IFUB=40ORUB=188UD=UD+1ELSEIFUB=41U
D=UD-1ELSEIFUB=147UE=UE-1
65444 IFUB<>58ANDUB<>0GOTO65436ELSEUC=0:
OC=OA+UA-2:GOSUB65452:UF=UF-(OB=58):UE=U
E-(OB<>58)
65446 IFUD=0ANDUF>0ANDUI=0UF=0:IFUB=58GO
TO65436ELSEIFUG=0OC=OA:UH=1:GOSUB65452:O
A=OB:UE=0:GOTO65434ELSESTOP:UG=0:UF=1:GO
TO65446
65448 UG=1:PRINTSTR$(UE)"/";:IFUD<>0PRIN
T"PARENTHESES",,:UD=0ELSEPRINT"HASH",,:I
FUF=0UF=1ELSEUI=0
65450 GOTO65446
65452 OB=0:FORU=0TOUH:OC=OC+U:OC=OC+6553
6*(OC>32767):OB=OB+PEEK(OC)*256/(256-255
*U):NEXT:RETURN
```

Listing 2 - PTYPOS

```
65432 CLEAR3:DEFINTU:UB=0:OB=0:UC=0:UD=0
:UE=0:UF=0:UG=0:UI=0:OC=16548:UH=1:GOSUB
65452:OA=OB:LPRINT"TYPOS - THE BUG SPY:"
:CLS:PRINT"WORKING
65434 OC=OA+2:GOSUB65452:IFOB>64999GOTO6
5430ELSEUA=4:OE=OB:OC=OA+4:UH=0:GOSUB654
52:IFOB=58UA=5
65446 IFUD=0ANDUF>0ANDUI=0UF=0:IFUB=58GO
TO65436ELSEOC=OA:UH=1:GOSUB65452:OA=OB:UE
=0:GOTO65434
65448 LPRINT"LINE"OETAB(15)"STATEMENT"UE
TAB(32);:IFUD<>0LPRINT"PARENTHESES":UD=0
ELSELPRINT"COMMAND":IFUF=0UF=1ELSEUI=0
```




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Data graph evaluation

A graphic four-color VisiCalc utility

Models I/III

Timothy K. Bowman, Spokane, WA

It has been said that one picture is worth a thousand words and anyone working with VisiCalc has, at one time, desired to present statistical material in a graphic form. One exciting area is the current development of software that will transform VisiCalc data files into high resolution graphics. Micro Software Systems has taken a significant step in producing a series of BASIC programs and DIF templates that produce high resolution graphics on both dot-addressable printers and the IDS

Prism color printer.

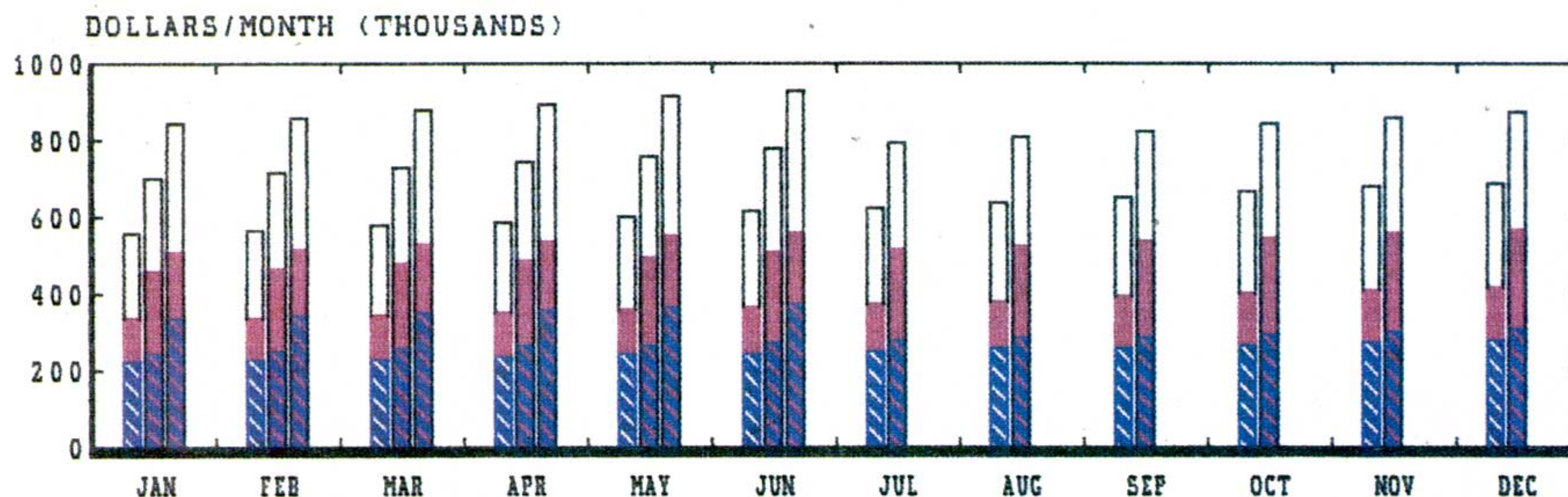
For this evaluation, I obtained a copy of the programs that would run on a Model III using TRSDOS and a Line Printer VIII. The programs are provided on either a Model I or Model III diskette that can be backed up. The operating programs must be transferred to a "clean" system disk and the distribution disk contains several sample files to be used in familiarizing you with the program.

In general terms, the programs are used in conjunction with

VisiCalc as follows. First, the VisiCalc program is loaded and the spreadsheet is created. After creation, it is saved in DIF format. You load a template which is a DIF file in a blank area of the worksheet. This template, called a Graphform, contains the desired graph features. Store the Graphform in DIF format. Exit the VisiCalc program by pressing the reset button. The Datagraph program then autostarts and prompts you with a request for a Graphform filename. If the file exists, the rest of the program

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DATAGRAPH BAR CHART

operation is totally automatic. As the program operates, it provides a screen display of what is being processed. Assuming the printer is on, the graph is automatically produced. Several examples that illustrate the quality of the printout are shown in the sample graphs.

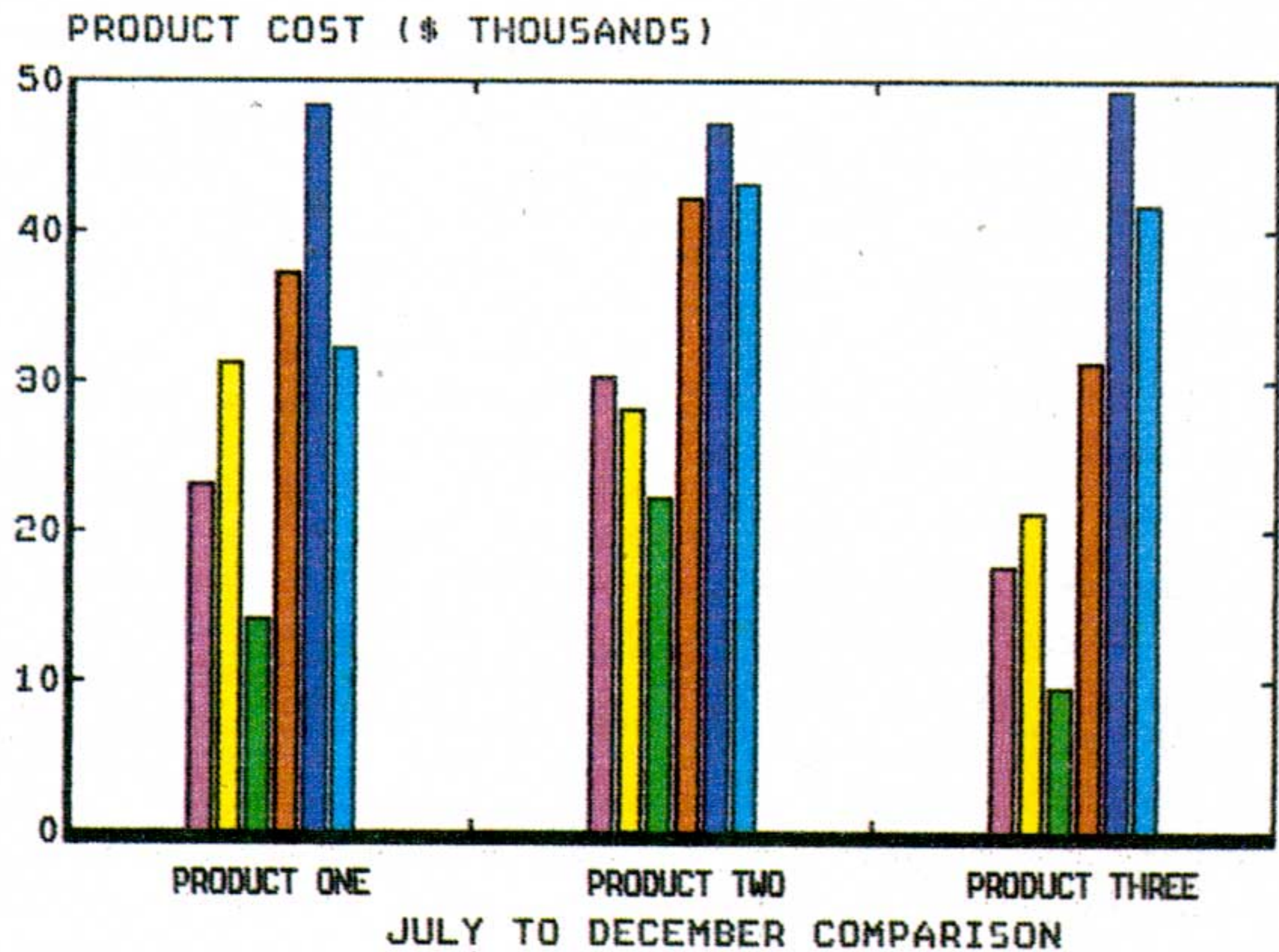
Features

The Datagraph programs provide several significant features. You can choose the title, axis labels, size of the graph, horizontal and vertical scaling, and twelve types of line format. You can create your own new symbols (a truly delightful process) through an edit routine. This routine is available through the main menu program and you can also view the disk directory on Model I/III non-TRSDOS systems. The programs have an auto-scaling feature that creates the graph scale necessary for the information yet the user can place maximum and minimum limits on the axis scales. The enhanced features, which now are really standard features on all current diskettes, provide extended graphing ability, including regular, relative, and superimposed bar graphs. Lastly, you can choose to produce graphs from only selected portions of your spreadsheet.

Impressions

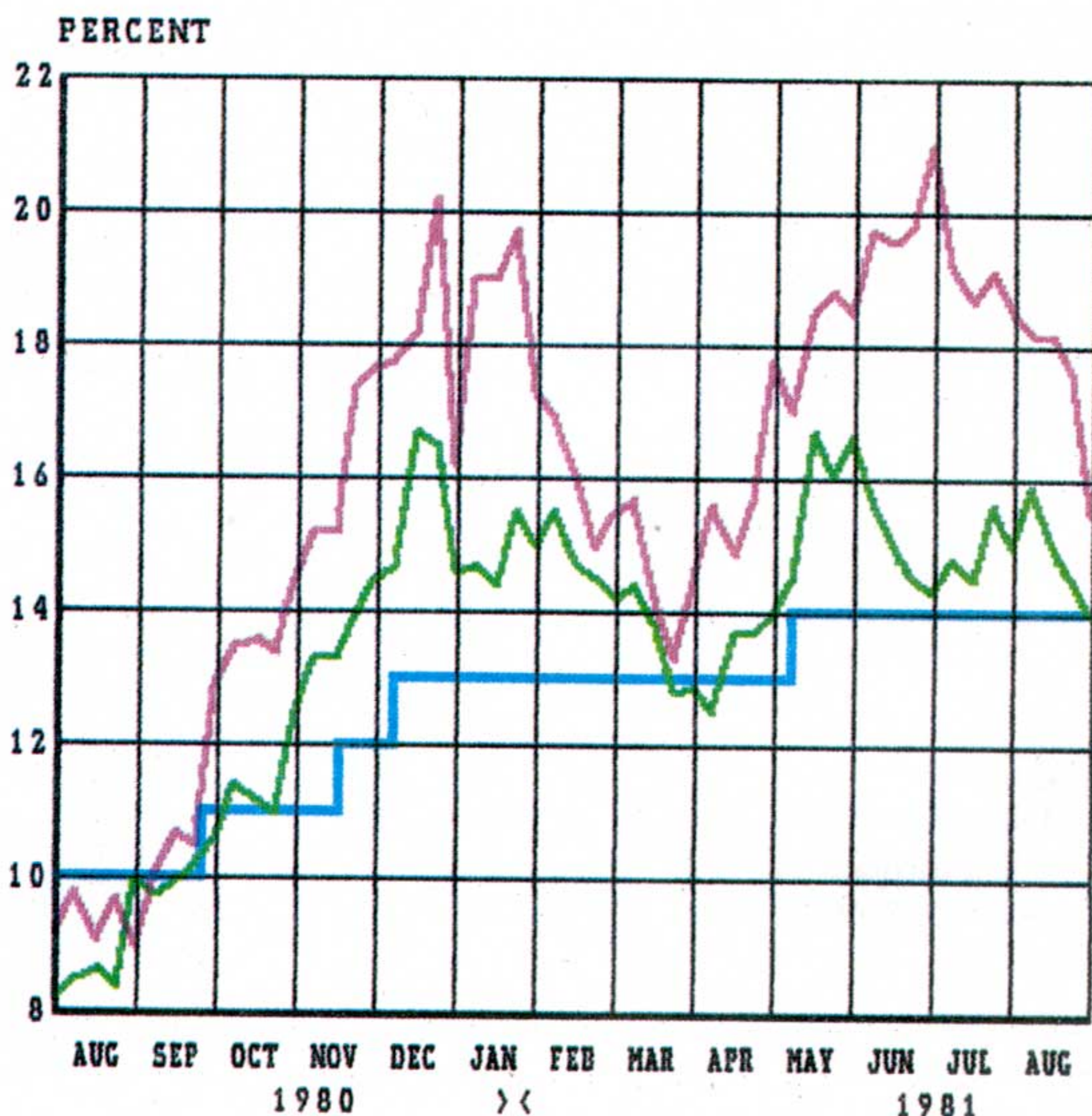
To sum it up, the programs work and the graphs are quite attractive. Once I became familiar with the product, it always produced results and was relatively easy to operate. I found the advertised "75 page manual" very unfriendly to use and it contained a number of spelling errors. Many of the 75 pages were used to present copies of printed graphs. I believe that this space could be better spent with more detailed and comprehensive explanations of how to use the product. In my opinion, the manual should be rewritten at a more elementary level and organized in a more logical fashion. It should include a very specific instruction session that uses one of the sample programs in connection with VisiCalc and Datagraph. It would also help to spread out the information presented on each page. Finally, it would be nice to have a

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Data graph

section at the end of the manual that contains hints for the advanced user.

I did not try to list or dissect the programs. They do, however, make extensive use of strings and there are periodic delays for "garbage collection." While the manual makes humor of it, I knew it to be unnecessary. Upon discussing it with the company, I was advised that a short patch is available to eliminate those delays. There appears to be sufficient error-trapping and I only noted one minor problem on one of the edit screens with the screen rolling forward. The company indicated to me that they were already aware of it, but that I was the first user to point it out.

There are two further program enhancements (after re-writing the manual) that I would suggest to further improve the product. First, it should be possible to create "pie charts" and second, to create, and edit, the Graphform file (containing the graph creation information) without going back to VisiCalc. But, neither of these suggestions are meant to detract from the usability

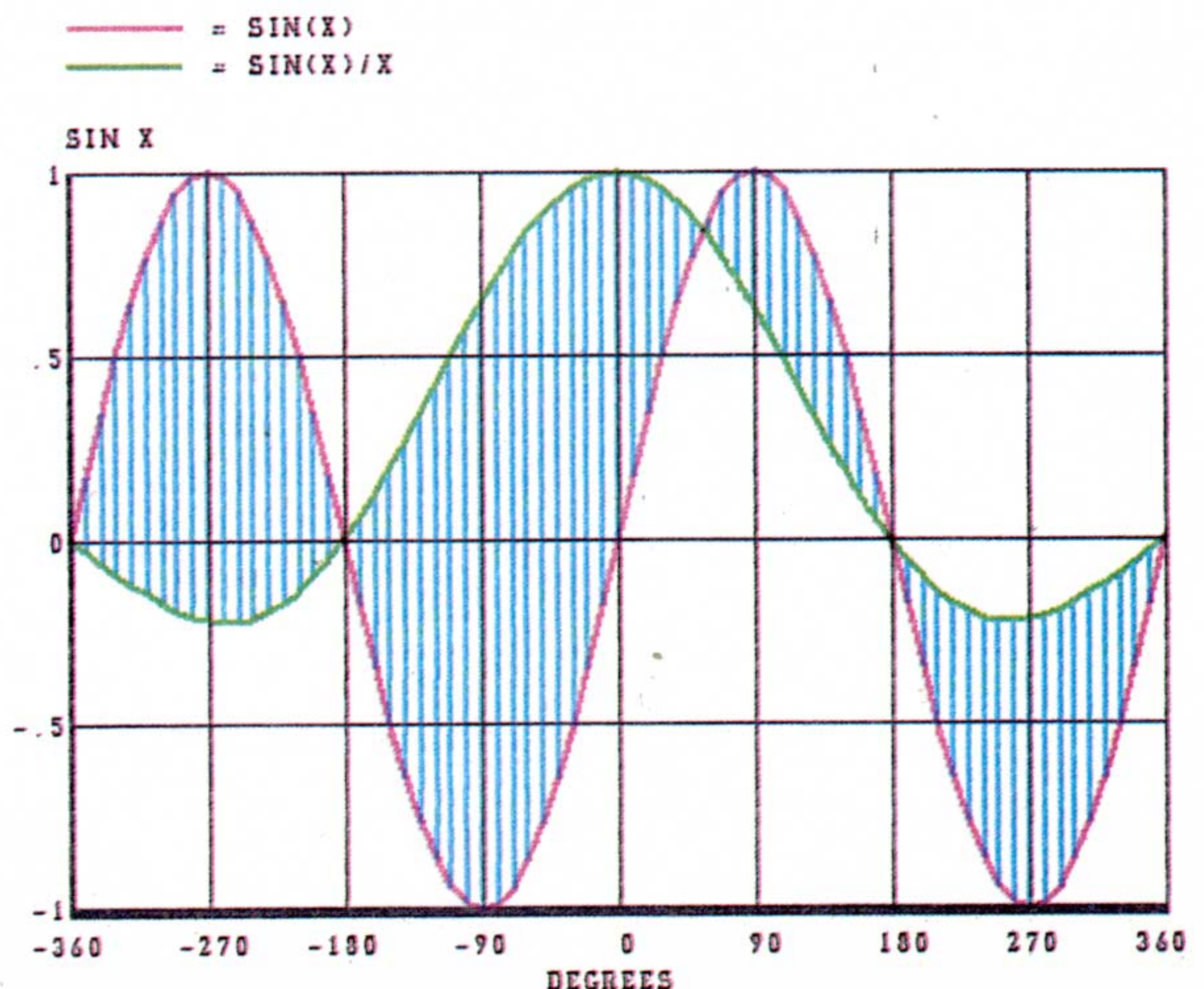
of the program as it is.

Despite my criticisms concerning the written documentation, for the Model I/III owner who wants to transform VisiCalc files to attractive, printed, graphics; this program must be considered. It is reasonably priced and the pictures are worth it. It opens up new frontiers in communicating information. That is what we are trying to do, isn't it?

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Datagraph is available for 48K Models I/III. Dual disk systems are preferred, but it will run under single disk systems that do not use TRSDOS. The package currently works under TRSDOS 1.3, TRSDOS 2.3, NEWDOS, NEWDOS/80, DOSPLUS 3.4, and LDOS 5.1. The package sells for \$79.95, or \$89.95 for the ColorPlot version. Contact Micro Software Systems, 1815 Smokewood Ave., Fullerton, CA 92631 or call (714) 526-8435. When ordering, be sure to specify printer, computer model, and DOS.

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122	78.26	972.78	481.43	115.12	136.34	1632	475	17,275	8,405			
105	79.08	972.35	405.77	117.81	137.97	1524	435	41,157	14,687			
188	79.14	981.89	402.89	117.16	138.12	1649	440	38,463	23,709			
107	77.29	980.89	391.19	115.19	135.98	216	1555	35,986	85,844			
103	76.20	985.79	383.41	114.97	133.06	578	1028	11,757	37,095			
109	76.44	983.59	384.82	112.89	133.48	907	620	28,733	15,737			
112	76.52	986.77	388.34	112.85	135.52	928	633	23,813	19,192			
113	76.35	985.10	387.18	112.49	133.24	578	993	12,407	24,532			
114	76.55	986.47	389.35	112.38	133.47	914	612	23,382	13,773			
115	76.99	989.77	396.10	112.60	134.20	789	591	21,567	13,536			
116	77.33	973.29	401.78	113.22	134.77	880	642	23,22	14,425			
119	78.10	970.79	403.55	114.35	134.37	740	750	16,114	15,338			
120	75.81	950.63	394.89	113.80	131.65	371	1172	5,859				
121	75.39	946.25	392.46	113.80	131.36	547	754	15,737				
122	74.76	940.44	392.03	113.00	130.26	467	1024	11,057				
123	74.72	940.19	391.61	111.76	130.23	683	780	16,604				
126	74.45	938.01	389.19	111.47	129.84	554	898	14,894				
127	75.19	949.44	394.64	111.72	131.12	943	559	28,175				
128	74.79	942.50	395.43	112.49	130.34	636	788	14,453				
129	74.69	948.89	398.04	112.74	130.24	774	710	19,435				
130	74.27	947.27	402.22	112.82	129.55	727	776	16,777				

WORKSHEET				
near NYSE Vol	10d NYCI	A-D	ADL	
1231	41.21	77.83	447	-1592
102	28.87	77.49	567	1025
105	38.71	77.78	893	-132
106	67.40	78.92	407	277
107	92.89	77.89	-1339	-1062
108	55.35	77.59	-450	-1512
109	50.19	77.38	289	-1223
112	48.76	77.23	295	-928
113	48.92	77.07	-415	-1343

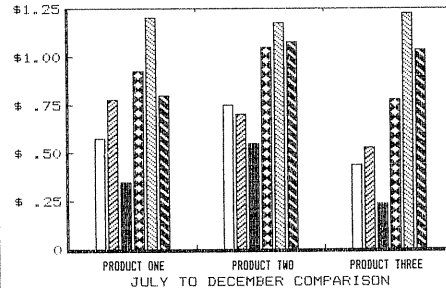
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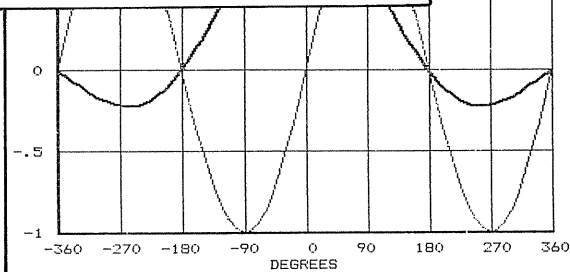
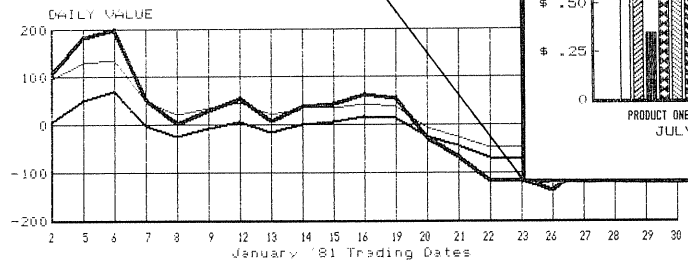
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- TRS-80 MODEL I 48K
- TRS-80 MODEL III 48K
- LNW80 48K

DOS

- TRSDOS 1.3, 2.3
- NEWDOS, NEWDOS/80
- DOSPLUS 3.4, LDOS 5.1

DISK DRIVES

- SINGLE DRIVE (NOT TRSDOS)
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In the chips

More uses for a byte and a tour through ROM and RAM

Model I/III

Spencer Hall, Associate editor

Last month we left you stranded in the wasteland between memory address 12287 (2FFF hex), last byte of the ROM and 15360 (3C00 hex), first byte of screen memory. We had just looked at the keyboard matrix between 14337 (3801 hex) and 14464 (3880 hex) with the help of a short program to scan these addresses. I won't apologize for leaving you in this lonely place. If you have the inquiring mind typical of someone who is attracted to personal computing, you have probably been using our little monitor to explore other parts of memory. Some apology is in order for taking from February to now to prepare you for writing machine language programs. Believe me, it was really necessary. Would it help to know that next time we will be writing our first machine language program? Yes, this month's trip through the rest of memory is the end of our basic training. (No pun! This isn't a course in BASIC.)

For now, let's get on with our field trip through memory. In case you missed the last installment, we're relisting the monitor again (Listing 1). It has been modified for some difficult terrain that we'll be crossing. If you have your copy of this monitor, it's a simple matter to add the new lines which are numbers 15 and 55 and all those from 170 upward. The listing contains remark statements (no need to copy them!) to identify the changes. This is the vehicle we use to take our trip.

RUN it, for now without lines 15 and 55. It will ask for a start address. Respond in decimal, specify about 0.5 seconds to hold each address, and away you go. Stop it with any key. Start it with any key. While it is stopped, press "A" to change the starting address, hold time, or both. Also while it is stopped, press "N" to see the integer stored in the present and next oncoming addresses.

Before we leave the 12288 to 15359 wilderness, let's look at the only other valid address in this RAMless arena. Start at 14310 (37E6 hex), or lower, and creep up on 14312 (37E8 hex). If you don't have a line printer, or have it turned off, you will see only 255. This address is the launching pad for any ASCII byte you care to send to the line printer. (To a line printer, any byte is an ASCII byte because it's a message to a human being.) Put a byte in this address and it goes onto eight wires of the parallel printer cable, or it's intercepted by the RS-232 serial driver. In either case, its destination is the buffer

of your printer. This heavily used address is also the line printer's mailing stop for messages back to the computer. When it is busy putting letters on paper, it places a 128 in this address (bit 7 high). This is a "Do not disturb" sign. While it is there, the computer patiently loops, waiting for a chance to output more bytes.

It's high time we explained the words "loop" and "buffer". From the time your computer is turned on, the microprocessor is busy reading addresses and switching bits in response to pulses from the "clock". It simply can't stop because electrical current continues to flow. When pauses are needed to allow you to do something, the machine code must go around in circles, testing for a chance to exit its loop on each trip around. Without such a test programmed into the loop, the poor microprocessor just goes around and around forever, at least until the power is shut off. This is the dreaded "infinite loop".

A buffer is simply a specified series of addresses in which to store bytes. In the computer, these are specified by an address number. In the line printer they are addresses in the printer's memory chip, visible only to the printer and completely inaccessible by the computer.

With a line printer you can have fun with address 37E8 hex. Exit the monitor with BREAK. With your computer on-line, type the following while in command mode: POKE 14312, 65: POKE 14312, 13. Now press ENTER. This executes the two BASIC commands. The first puts the ASCII byte for capital A (65) in the print buffer. The second POKE puts the ASCII for a carriage return and a linefeed (13) into the buffer. That is, for most printers, a signal to empty the buffer. The result? You get the letter A printed (and another wasted sheet of paper!).

You may want to try this little program:

```
10 FOR B = 65 TO 90
20 POKE 14312, B
30 NEXT
40 POKE 14312, 13
```

The loop from line 10 through 30 puts the twenty-six capital letters of the alphabet into the print buffer and line 40 tells the printer to empty its buffer.

Before leaving this address, try doing a PRINT PEEK (14312) when the printer is off. You get 255, because there is nothing there now. Now do it with the printer on, but off-line. Do it once more with the printer on and on-line. Note these last two values. Their hex equivalents will be very handy when your machine language programs test address 37E8 hex to see what's going on in the line printer.

We've already said that addresses 15360 (3C00 hex) through 16383 (3FFF hex) wired or "mapped" to positions on the video screen. They are equivalent to PRINT @ addresses 0 through 1023. Try POKEing some ASCII values into these addresses from command mode, e.g. POKE 15704, 97. If your computer has a lowercase modification, this will put an "a" near the middle of the screen. Otherwise, you'll see a capital "A".

From 16384 to the start of BASIC, which in Level II is 17129 (42E9 hex), lies a scratch pad which is used by the machine code in ROM to make all kinds of notes to itself. Entries to this area are made by the ROM when the ENTER key is hit after the MEMORY SIZE (or MEM SIZE) question has been answered.

There are a number of "where to go next" instructions. These are used by machine language programs to modify the behavior of the ROM. Machine code in ROM is written to periodically visit these addresses while it is executing a BASIC program or responding to BASIC commands. They normally contain the machine language equivalent of RETURN (which is decimal 201, or C9 hex), known in source code as RET. Thus, nothing at all happens as a result of this microsecond diversion.

The next two bytes are left vacant. By changing one of these addresses to 195 (C3 hex), which is the machine code equivalent of GOTO, known in source code as JP, and adding the LSB and the MSB in the next two addresses; it is possible for a machine language program to kidnap the system off to code at a totally different location.

This code modifies the behavior of the system. It may execute a debounce routine, a shift from upper to lowercase, or anything else the programmer desires. Ending with the C9 byte send it back to the system as if nothing had happened. These so-called "exits" were written into the ROM for this very purpose. Their intended use is conversion of the ROM to operate a disk system. For this reason, they are known as DOS exits.

Many machine language programming efforts on the TRS-80 require a knowledge of where these exits are. You can see the DOS exits, as we have just described them, by running the monitor from 16812 through 16868.

Another group of exits, the disk exits, can be seen from 16722 through 16811. These already contain a 195 (C3 hex), which, as we have said, means JP or GOTO. Read the next two bytes with your "N" key. Unless you have a disk system activated, the address is 431 in ROM. Disk exits respond to the Disk BASIC reserved words. The code at 431 (1AF hex) in ROM writes the L3 ERROR message, naturally!

A whole book could be written about what is stored in this scratch pad. You'll need to know a lot about this area when you write machine language, but it will be better to talk about these things when you are ready to



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use them. For now, read address 16548 with your "N" key. That's where the ROM stores a BASIC program when you write or load one. In Level II this is 17129 (42E9 hex). If your system uses a different starting address, you'll find it in LSB/MSB format at 16548. Using the "N" key, you can read the following information at these addresses:

16561 The end of BASIC memory. This is the top of your system unless you've answered MEMORY SIZE? with something besides ENTER.

16544 The lower limit of string storage. This is fifty bytes lower than the previous number unless you've CLEARED more space.

16633 The start of numeric variable storage. This is three bytes beyond the end of the BASIC program.

Now, add lines 15 and 55 to your monitor (assuming you already have the lines from 170 on) and RUN it. You'll see the entire BASIC vocabulary appear on the screen, a word at a time. The number preceding each word is the byte, called a token, which is stored in place of the actual word.

They are being loaded into matrix W\$ for use by the monitor to interpret the BASIC area of RAM. Where did they come from? They are not in our program.

The program found them between addresses 5712 and 6177 in ROM and simply moved them up. Use the monitor to examine the string storage area whose location we've just shown you how to find. There they are, sitting there ready to be put on the screen when the

monitor needs them.

RUN the monitor from an address three or four bytes below the start of BASIC (the numbers you found in 16548 and 16549). That's the monitor itself, being listed address by address, with bytes representing the reserved words properly decoded. The jump of five addresses every once in a while happens when the monitor "sees" a new line. The zero is the end of a line. The next two bytes are the address of the next oncoming line. The last two bytes that make up the jump are the current line number in LSB/MSB integer format.

Start the monitor about ten addresses below the start of the variable table you found at addresses 16633 and 16634. You'll come to the three zeros which identify the end of a BASIC program.


Just one more important point. String storage is at the "top". BASIC tosses strings up and they stick to the ceiling. If you have a machine language program stored at the top of memory, and haven't protected it by placing an address below it in 16561 and 16562, it's just too bad. BASIC will wreck it with a string or by building a stack up there. We'll talk more about stacks later.

Are you ready to write some machine language? Here's a question to test your wits. We said that the reserved words appeared in ROM between addresses 5712 and 6177. Run your monitor and look at them. There they all are, lying there beheaded. Why? What is odd about the byte representing the first letter of each? We'll discuss what is going on next time.

LC Compiler

The "LC" Compiler provides a substantial subset of the C programming language with:

- Integer subset of C; has access to floating point ROM routines via functions
- All statements supported except: SWITCH-CASE, GOTO, TYPEDEF, STRUCT, UNION.
- All operators except ">", "<", SIZEOF, (typename).
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- Compiled programs run on both Model I and Model III
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- LC/LIB includes: FPRINTF, PRINTF, ALLOC, FREE, SBRK, and String functions.
- LC: The Mod I/III version includes: LC/CMD, LC/LIB, FP/LIB, IN/LIB, EDAS-IV, XREF, and more than 200 pages of documentation. Requires 2-drive 48K LDOS. Mod 1&3 for LDOS: \$150+\$4S&H



LDOS 5.1

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- One-level MACROS support parameter substitution by position and by keyword.
- Local labels in both MACRO expansions & PDS searches.
- Supports +, -, *, /, .MOD, .AND., .OR., .NOT., .XOR.
- Constants can be declared as base 2, 8, 10, & 16 or string, with more than one value on a single line.
- 15-char labels including special chars: @, ?, \$, _
- Extensive cross-reference utility & EQU generation.
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Program Listing for In the Chips

```

10 CLS
15 CLEAR 1000:GOSUB 170
    *** NEW ***
20 PRINT:INPUT"START AT WHAT ADDRESS";A
30 PRINT:INPUT"HOLD EACH ADDRESS HOW MANY SECONDS";S
40 IF A>32767 THEN A=A-65536
49 ' *** "B<192" IN LINE #50 CHANGED TO "B<128" ***
50 B=PEEK(A):IF B>31 AND B<128 THEN B$=CHR$(B) ELSE B$=""
55 GOSUB 350
    *** NEW ***
60 PRINT A,B,B$;
70 FOR J=1 TO 345*S:NEXT
80 Z$=INKEY$:IF Z$="" THEN 130
90 Z$=INKEY$:IF Z$="" THEN 90
100 IF Z$="A" THEN 20
110 IF Z$="N" THEN 150
120 IF Z$="S" THEN 30
130 A=A+1
140 PRINT:GOTO 50
150 PRINT PEEK(A)+256*PEEK(A+1);
160 GOTO 90
169 ' *** ALL THE FOLLOWING LINES ADDED ***

```

```

170 DIM W$(122)
180 WI=0:A=5712
190 I=1
200 X=PEEK(A)-128
210 W(I)=X
220 A=A+1:I=I+1
230 IF A=6177 THEN 300
240 X=PEEK(A)
250 IF X<128 THEN 210
260 FOR J=1 TO I-1
270 W$(WI)=W$(WI)+CHR$(W(J)):NEXT
280 PRINT WI+128;W$(WI)
290 WI=WI+1:GOTO 190
300 BA=PEEK(16548)+256*PEEK(16549)
310 BZ=PEEK(16633)+256*PEEK(16634)
320 PRINT"HIT ANY KEY TO CONTINUE"
330 Z$=INKEY$:IF Z$="" THEN 330
340 CLS:RETURN
350 IF A<BA-2 OR A>BZ THEN RETURN
360 IF B=0 THEN AD=PEEK(A+1)+256*PEEK(A+2):IF AD<BA OR AD>BZ THEN RETURN ELSE GO TO 390
370 IF B>127 AND B<251 THEN B$=W$(B-128):RETURN
380 RETURN
390 FOR J=A TO A+4:PRINT J,PEEK(J):NEXT
400 A=A+5:GOTO 50

```

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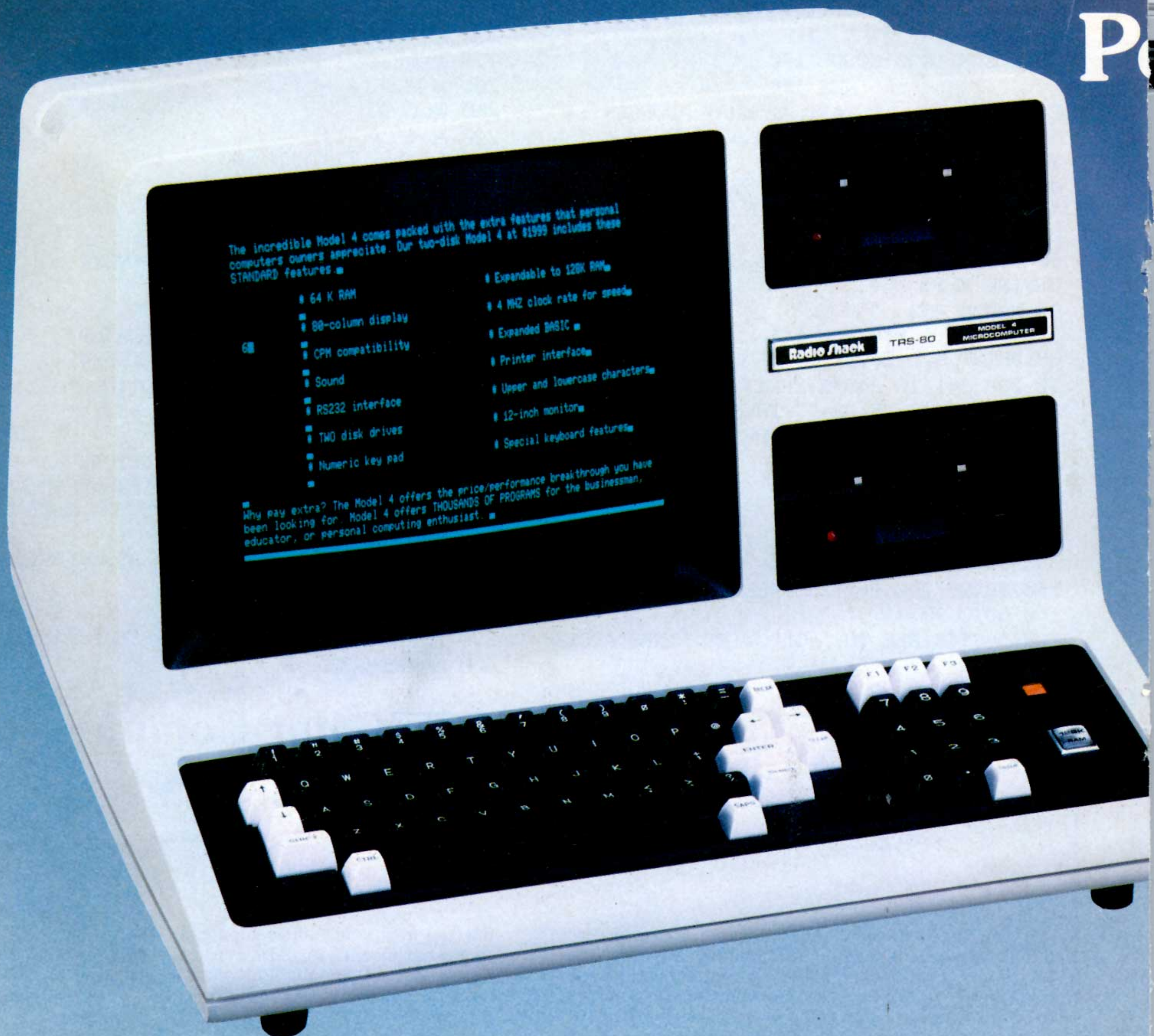
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BASIC bits

Machine identification: PRINT USING and other tips

Model I/III

Thomas L. Quindry, Burke, VA

Parsons Pilcher of McLean, Virginia, comes up with this little gem for Scripsit. I had never really thought about this myself, but it is really logical based on the structure of Scripsit commands.

If you want to print multiple copies of a Scripsit file, use the REPEAT function. Tell how many times you want the command repeated and then hit BREAK and P or P,S for serial printing.

Sometimes, it's nice to know what computer your program is running on. In Table 1 are some locations to PEEK at to see not only whether your program is running on a Model I or III, but also to see whether it is a disk or cassette system and, on the Model I, whether it has only uppercase or upper- and lowercase. You have to use PRINT with all of the commands under the address column except for the POKE command.

After POKEing the video at 15360 with 255 and PEEKing at the value you get, you may want to POKE 15360,32 to replace the resulting graphic character block with a space.

I have to caveat the probable Disk BASIC Start. These pointers, which are used to compute the Level II BASIC Start and Disk BASIC Start addresses, can be changed by programmer control depending on the application. A different address from the normal Level II BASIC Start does not necessarily mean you are in Disk BASIC.

The next little tidbit should be of interest to many of you who use the PRINT USING statement in your BASIC programs. It's not given in any of the Radio Shack manuals, but did you know that you can specify more than one format in your USING string? Then, when you print out more than one variable, the successive variables use the next consecutive format. If only one format specifier is given, it is used for all of your variables.

For instance, run the following program:

```
10 A$="####.##"
20 A=34.443: B=122.6888: C=1.1
30 PRINT USING A$;A;B;C
```

Each of the following variables, A, B and C, are formatted to two decimal places. Now, change line 10 to

read:

```
10 A$="###.## ###.### $###.##"
```

You will now get the following values printed: 34.44, 122.689 and \$1.10.

In the formatting string, A\$, the space is all you need between each format specifier. Now, even more interesting, what happens if you were PRINTing more than three variables in line 30, but your formatting string only gives three formats? Your BASIC program starts over, using the formats specified, and continues in consecutive order. Variables 1, 4, 7, etc., would use the first format, ###.##; variables 2, 5, 8, etc., would use the second format, ####.###; and variables 3, 6, 9, etc., would use the third format, \$###.##.

Question: How do you relocate the start of BASIC so that a machine language program can be placed before the program and be protected? — N.T., Falls Church, VA

Answer: This is somewhat akin to how Disk BASIC is loaded in memory before BASIC, which starts just after that in memory. The procedure is rather simple. As an illustra-

tive example, suppose that you wish to start your BASIC programming at 5001H. The preceding byte (5000H) must be a zero. In the BASIC command mode, POKE 20480,0. This poke address is the equivalent of 5000H. Next, you must change the pointer located at 40A4H and 40A5H (16548 and 16549 decimal) to indicate the start of BASIC at 5001H. To do this, you must break down the address into its high and low significant bytes and POKE

them into the above addresses, LSB first and MSB second. In hexadecimal code, the 50 is the most significant byte (MSB) and 01 is the least significant byte (LSB). Since it is still a hexadecimal number, to get the MSB in decimal, multiply $5*16+0*1$ and get 80 decimal. The LSB is $0*1+1*1$, or 1 decimal. So, now we have POKE 16548,1 and POKE 16549,80. The vectors indicating the start of scalar and array variables and the end of array

Table 1

Address	Value	Decision
PEEK (293)	73	Model III
PEEK (293)	Other	Model I
If a Model I		
PEEK (14316)	255	Cassette
PEEK (14316)	1	Cassette
PEEK (14316)	Other	Disk
POKE 15360,255		Preceding next PEEKs
PEEK (15360)	255	Upper- and lowercase
PEEK (15360)	191	Uppercase only
PEEK (16548)	233	With next PEEK
PEEK (16549)	66	Normal Level II BASIC Start
PEEK (16548)	Any	With next PEEK
PEEK (16549)	Other	Probable Disk BASIC Start
If a Model III		
INP (240)	255	Cassette System
INP (240)	Other	Disk System
PEEK (16548)	233	With next PEEK
PEEK (16549)	66	Normal Level II BASIC Start
PEEK (16548)	Any	With next PEEK
PEEK (16549)	Other	Probable Disk BASIC Start

Table 2

LD	HL,5000H	
XOR	A	;A = zero
LD	(HL),A	;load zero byte
INC	HL	;increment HL
LD	(40A4H),HL	;load BASIC pointer
CALL	1B49H	;CALL NEW
LD	BC,1A18H	;return to
JP	19AEH	;ready

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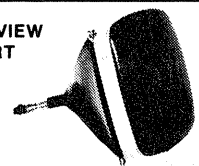
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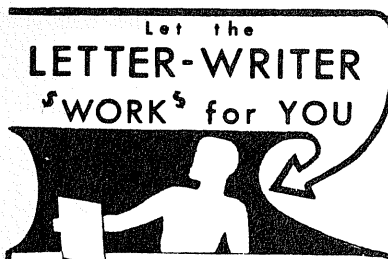


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
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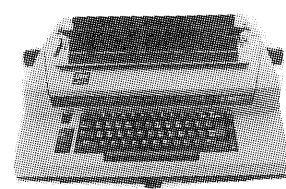
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BASIC bits

variables must now be set. The easiest way from BASIC is to simply use the NEW command. This automatically sets these pointers. CLOAD also does it after loading a program.

If you are writing a machine language program to occupy that area now free before your BASIC program, you can change these addresses with the assembly language mnemonics in Table 2.

The last two instructions return you properly to the BASIC ready command on both the Model I and Model III. With the Model I, you could substitute one instruction, JP 06CCH, for these two, but on the Model III it will reboot you to the CASS? and MEMORY SIZE? questions.

Now! What areas can you start programming? The Model I address area would be from 434CH to two before you start BASIC. In our example, up to 4FFFH. With the Model III, you would be 256 bytes higher to start, or 444CH. This gets you above any area of memory that is destroyed by rebooting. If you know your starting address for initializing the BASIC and other pointers set up by your program, you could just hit <SYSTEM>, then </?????>, and your utility would be run again. If you know how to reset your BASIC pointers lost by the CALL 1B49H, you can even save your BASIC program in memory. More on that in a future column.

That's the clean and simple way. If you weren't concerned with reboots, you could start your machine language program at 42E8H and 43E8H for the Model I and Model III, respectively.

Question: Is there a way to start a BASIC program while in a machine language program? —T.F., Rowland Hts., CA

Answer: There are three ways that come to mind. Two are equivalent and start you at the beginning of the program. One can be used to start you in the middle of a program. First:

```
LD HL,1D1EH
PUSH HL
JP 1B5DH
Or, second:
CALL 1B5DH
JP 1D1EH
```

To run from the middle of a

program:

```
CALL 1B64H
LD HL,XXXXH ;XXXXH is the
               address of any
               colon or ASCII
               zero at the end of a
               BASIC line
```

JP 1D1EH

The last method can be sort of neat in that you can run lines that logically can't ever be run. Consider the following:

```
10 GOTO 20 : PRINT "THIS CAN
   STILL BE PRINTED!"
20 PRINT "ORDINARILY, ONLY
   THIS WOULD BE PRINTED!"
```

If you load HL with the address of the colon (:) in line 10, the statement, PRINT "THIS CAN STILL BE PRINTED!", will execute. You can find this address by doing the following:

```
PRINT PEEK (16548), PEEK
(16549)
```

If you have written the BASIC program exactly as I have, add nine to the value in PEEK (16548) and then, if the SUM is less than 256, use that SUM as the Least Significant Bit (LSB) and PEEK (16549) as the Most Significant Bit (MSB) of the address to use. If the sum is greater than 255, LSB = SUM - 256 and the value of PEEK (16549) - 1 will be the MSB.

In BASIC, you can easily POKE the values of the short machine language routine (third method) into memory somewhere and jump to it with the SYSTEM </address ENTER> commands. The numbers to POKE are: 205, 100, 27, 33, LSB, MSB, 195, 30, 29.

The third method could probably be used to create a hybrid program that is mostly machine language. To do certain functions, you could jump back and forth between the machine language program and BASIC statements which could be loaded along with the machine language program.

Remember to send your requests for future column topics, questions and tips to me, care of 80-U.S. Journal, 3838 South Warner Street, Tacoma, WA 98409. Send a self-addressed, stamped envelope and I will try to give you a personal reply if the answer is not too long and involved. Problems of general interest may be included in future BASIC Bits columns.

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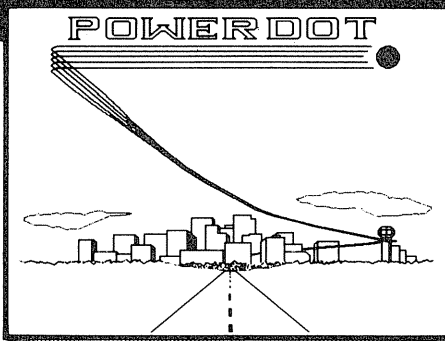
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Tandy topics

Ed Juge, Director of Computer Merchandising
1500 One Tandy Center, Fort Worth, TX 76102

I indicated last month that the Model 12, Xenix, ARCNET, PC-4, and Model 100 weren't all we had up our corporate sleeves for '83. I'm sure the Model 4 is being covered in this issue, so I'll try to contain my enthusiasm and keep from producing a second "review".

Your impression will no doubt be "Big deal! They painted the Model III white." Look again! You'll find it's really an all new computer in a Model III case... and more. So, let's see some of what's really there.

In our opinion, a "new model" must offer new and exciting user benefits. At the same time, when you have a winner, you want to keep momentum going, and existing customers happy. So, the Model 4 had to maintain 100 percent compatibility with existing Model III programs.

You could say Model 4 contains an "embedded" Model III (which doesn't support Model 4 features). When in that mode, every Model III program can... should... ought to... uh... might... no... will work! At least that's the objective. So far, we've tested every cataloged Radio Shack program (and some old ones that aren't around any more), and every one runs. No conversions, no fancy footwork. We learned a lesson from the "almost compatibility" between Models III and I. Of course, I'll concede that in this business, guaranteeing is foolhardy. Someone could uncover an exception when the first wave of owners crams 1,000 man-years of testing into a month.

Upgrades

Every time we reduce a price or build a new computer, we're accused of forsaking current owners. Well,

we hope you won't feel that way this time! For about \$800, you Model III owners can keep your disk drives and video (which haven't changed anyway), and your Mercedes Silver case, but change out the other electronics, keyboard, and even the nameplate, to pure Model 4!

The cassette Model 4 operates just like a cassette III. All the neat new features are disk only. The cassette machine, you might say, always operates in Model III mode. But when you add a disk, you'll get all the goodies.

So, how about features, compared to a Model III? Immediately apparent are the white case, new keyboard with CAPS, CTRL, and three programmable function keys. Then there's the 80 x 24 screen, reverse video, sound, compatibility with CP/M (we'll have CP/M Plus available shortly) and LDOS, plus you get TRSDOS 6.0 and a dynamite new BASIC that includes COMMON, CHAIN, SWAP, WHILE... WEND, and lots more. Additionally, the disk machine is now 64K RAM-based, expandable to 128K. (Model III mode is still 48K, and switches in a Model III BASIC ROM for full compatibility.) The 4's clock speed is now doubled to 4Mhz, when using TRSDOS 6.0. The mode (III or 4) is determined by the operating system disk you use.

TRSDOS 6.0 features extreme flexibility and power. There's the ability to create a "memory disk" in any unused RAM to make "disk accesses" lightning-quick. Fill up that memory, with program or system overlays for amazing speed. "Filters" can be used for all I/O devices, including keyboard and

video, allowing you to define characters, strip characters out of text, and configure the output format to match the printer. You can reconfigure your keyboard, should you be an advocate of, say the Dvorak keyboard. In addition to filtering, you can ROUTE user I/O devices (keyboard, video, printer, etc.) to one another, even route paper output to disk if your printer is temporarily out of service. Want to keep a record of screen inputs? You can LINK your video to your disk, and store it all.

If you like IBM's clicking keyboard, fine -- use the keyclick filter. (Ham radio Morse code operators take note: Bet you never thought you'd see a desirable "keyclick"!) There's even a Model 100 cassette support utility.

In fact, my hack-programmer, non-engineer impression of the Model 4 is that it's simple to use, yet totally configurable. It could almost be viewed as a "black box" computer in a cabinet with drives, video, and keyboard. For the user, all this horsepower can at once be functional, yet absolutely transparent. No, friends, a repainted Model III it isn't. And you'll be happy to know we've been building them for several months, so they're available today. Drop in for a look, or take one home with you.

I'm finishing this column up on Sunday morning at the breakfast table, on my Model 100. I'll dump it into Scripsit later for formatting, and I fully expect to find it to be too long. I can hear Cam Brown's phone call now... "Ed, this is your editor. We need to cut..." (We did --Ed.) Tune in next month, the excitement isn't over yet!

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Captain 80

and the magic software machine

Bob Liddil, Contributing editor

The bright New Hampshire sun shone through the third floor window and over the top of Max's Expando box, warming his EPROMS, alerting him to the new day. He never sleeps, at least he never mentioned it before. However, I do, and he takes fiendish delight in awakening me at odd hours of the morning.

This morning though, his attention was diverted from me and directed toward a new program that had arrived in the mail the night

before. The mechanical hands that I'd fashioned for him from some of Professor Megabyte's old blueprints were ideal for handling cassettes and disks. I'd made them so Max could load himself and not be bugging me all the time.

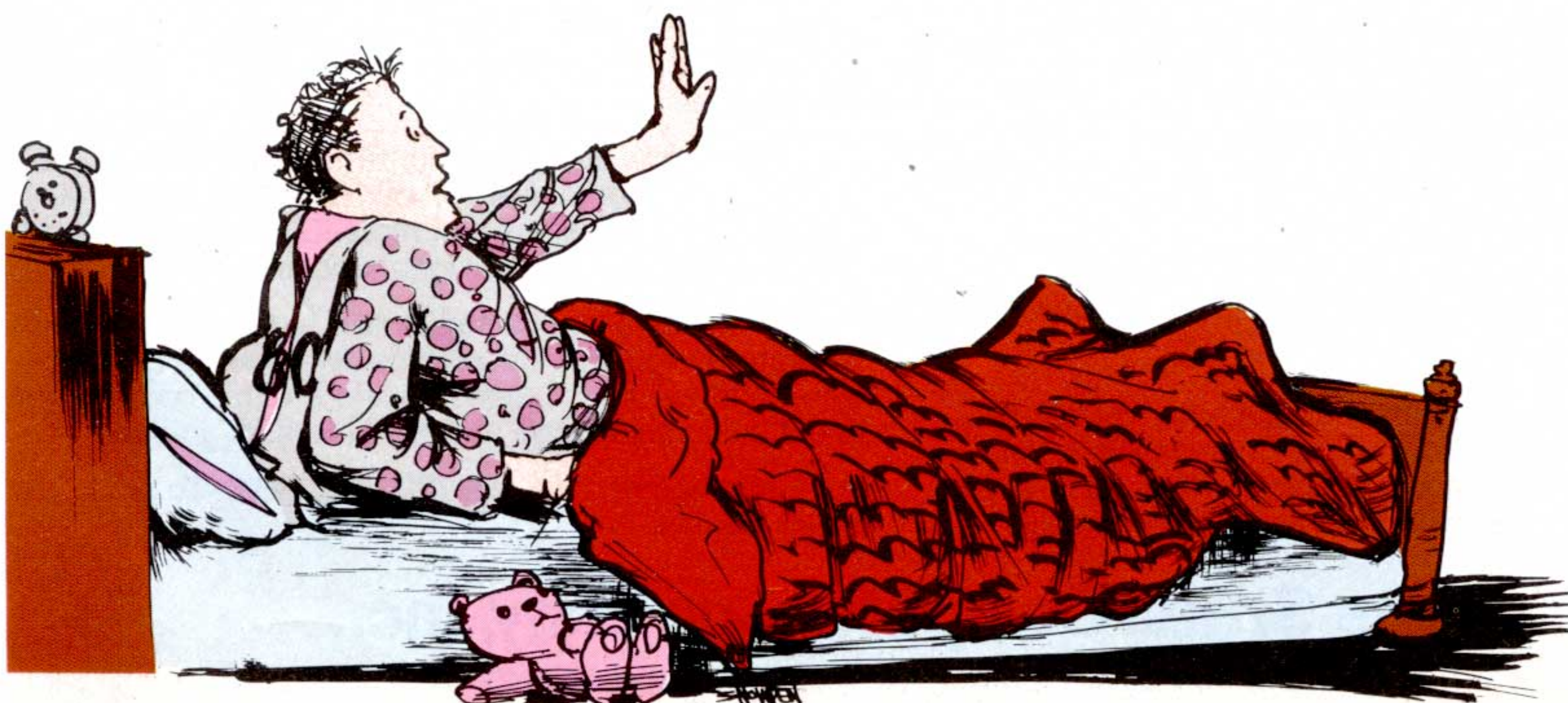
Some people never learn.

I was awake, just barely, after a long night of doing software secret missions for The Chief. In half-asleep fuzziness, I could make out a shape silhouetted against the sunlight that poured through the

window. It had the head of a bull, the body of a man, and a club the size of the leg of a Minotaur!

Yipe!

I had just enough time to dodge as the ghastly beast brought his massive club foursquare down in the middle of my new waterbed. The resulting tidal wave washed me out of the room, down two flights of stairs and into the street. I had very little time to collect my thoughts. The Minotaur burst through the second story window in a shower of glass and landed on two massive,



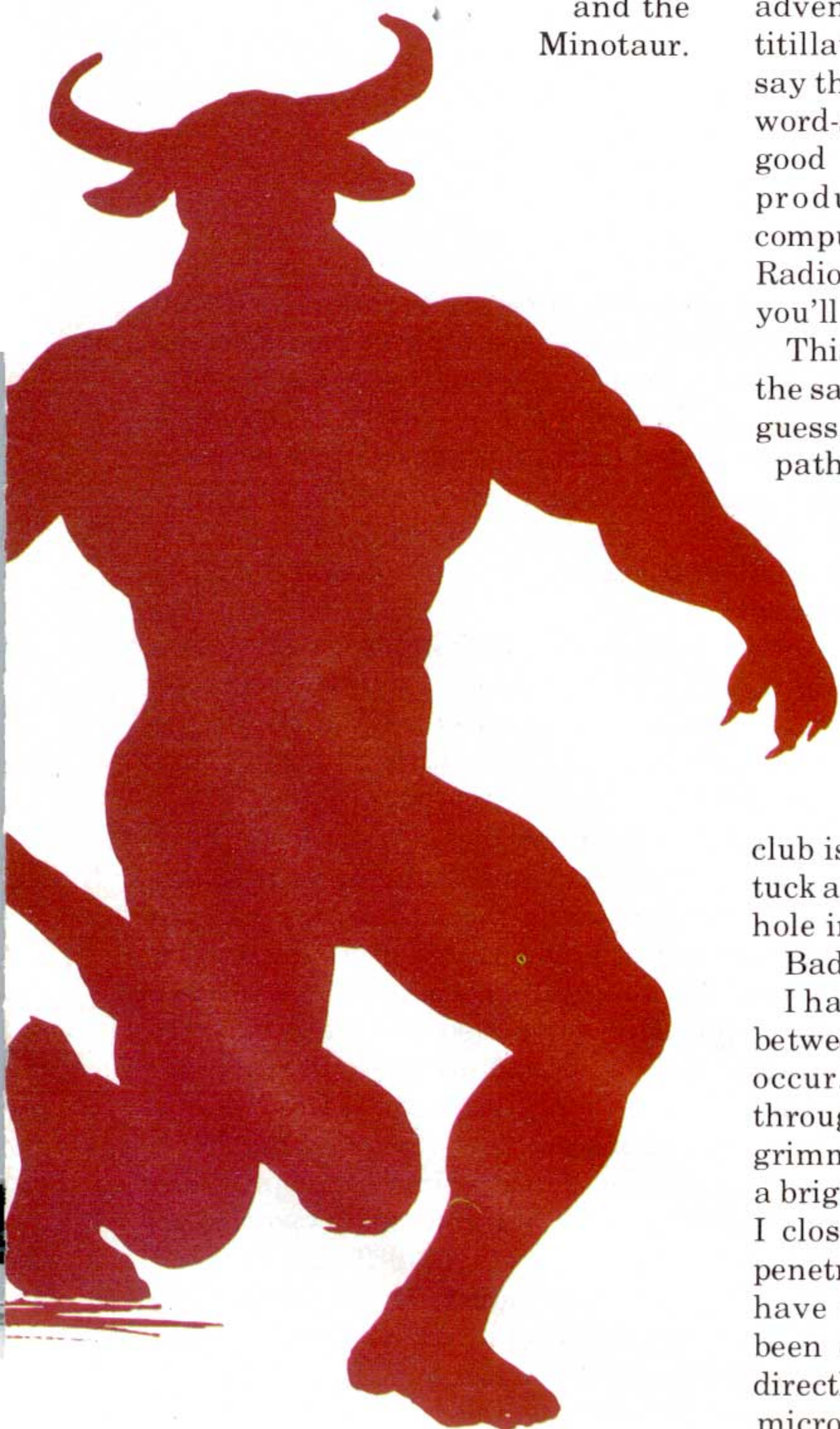
muscular legs, less than three yards from where I lay, wet, cold, dazed, and as mad as a software pirate at a cryptography convention.

"Max!" I yelled, at the top of my lungs, "Max, do something quick!"

My nosey neighbor shook her head in disbelief at the sight of me in my pink and gray pajamas, sitting in a puddle of water, about to be flailed into secret agent burgers by a mythical beast. She pulled down the shades.

It is just as well she did. Max activated his dimensional download system and de-rezzed me, and the hulk about to pulverize me. I felt that all-too-familiar sinking feeling and when I hit the ground, my worst fears were confirmed. I'd been downloaded into the new Spectral

Associates/Radio Shack
adventure game,
Madness
and the
Minotaur.



And you think you hate getting up in the morning.

Madness and the Minotaur is a new program for the Color Computer, distributed by the Tandy Corporation, produced by Spectral Associates. The text-style format is colorful in its descriptions, lavish in its location choices, and well laid out in the possibilities of movement.

The program I saw was an early Spectral version, appointed with the lackluster packaging that accompanied their first few offerings. Fortunately, more recent programs from these guys have good, four-color packaging so the dealers no longer have to apologize for them.

Anything I would say about the contents of Madness and the Minotaur would tend to spoil the surprise for Color Computerists casting about for a truly great adventure to puzzle the mind and titillate the imagination. Enough to say that this first and greatest of the word-simulations for the CoCo is a good buy, whether as a Spectral product at your independent computer store, or from your local Radio Shack. If you like adventure, you'll love Minotaur.

This place is not unlike Zork. It is the same in dungeons and fantasy, I guess, with roads to follow and paths to take. I've never come out

of any of these downloads with treasure. Maybe this will be a first. It seems pleasant enough, though calm is usually a sign of danger in adventures.

Ambush! The Minotaur leaps out from behind a wall and confronts me. His club is aimed squarely at my head. I tuck and roll to the side, diving into a hole in the ground.

Bad move, hot shot.

I have fallen into one of those gaps between programs that occasionally occur. I plunge straight down through blackness deeper than the grimmest night. I am falling toward a bright light, a light so intense that I close my eyes to avoid it. Yet, it penetrates. I realize, now, that I have fallen out of RAM and have been channeled along a trace line directly into the heart of a 6809 microprocessor. Always before, Max

has been there to help me, or the Professor. But in the CoCo, I am on my own. It's so bright, so dark. I spin, I hit.

I awaken in a cell of purest white. I can see, in the hallways, my guards. I recognize them. They are the grey-hooded specters from a three-dimensional graphics adventure for the Color Computer called The Phantom Slayer. Now I know I'm in trouble.

Phantom Slayer is a rich hybrid that falls between arcade games and adventures. It features the 3-D graphics popularized by Med Systems in Assylum and Labyrinth, but with a twist. Namely, the gruesome behooded guys roaming around the castle ready to do you in with such lightning speed that the game develops an almost impossible challenge.

The player is cast in the role of Phantom Slayer. The Phantoms are the the bad guys and can kill you with a single touch. Armed with a laser pistol, you move through the maze by the use of arrow keys. A Phantom detector alerts you to danger, and if you're fast enough...

Ken Kalish has kept the Med Systems legend alive through this most excellent of games. His use of positional graphics allows the player to feel *inside* the game. The strategy of play is well thought out. There is an overall excitement. While Med Systems can always be trusted to deliver more value than the cover price of a unit of software, it is a pleasure to review something that looks good, works well, and loads right the first time. This one's a winner.

They're coming for me. I am being taken into a great hall, among massive pillars of silicon, to a throne of pure silver. I am flanked on all sides by Phantoms and dare not bolt for fear of touching one.

A voice booms throughout the room and the courtiers are suddenly still. I look up at the throne and see a crowned being, sitting, glowering down at me.

"You shall pay for your crimes, infidel," it snarled.

And in the heart of the fastest and best microprocessor known to personal computing, I knew despair.

The king was Twitch.

Where does **PUT** really **GET** you?

Use these animated programs and
a game to find out

Color Computer with joysticks

Dale Fawcett, Strongsville, OH



Good game animation requires many things but speed is one of the most critical. If everything on the TV screen moves at a snail's pace, the game loses some of its excitement. This philosophy doesn't apply, of course, to games where there is a definite order of turns between players, where each makes a move and then the other decides on his next move before making it. But for a fast-paced "real time" game, the animation speed is most significant.

The idea of animation is very simple. A picture is displayed on the TV screen, then the picture is removed and redisplayed at a new location. This gives the impression of moving from one location to another. The effect can be enhanced by various techniques. For a person walking, two different pictures could be used alternately, one with left foot raised and one with right foot raised. For greater detail, more than two pictures could be used in a series. This not only gives the motion across the screen but the figure seems to be more alive since its parts appear to move also. Most objects only need one picture to be moved to present adequate animation. This article only examines this simple method of moving one picture.

To achieve the best and fastest animation, a program should be written in assembly language. However, an assembly language program is very difficult to write compared to BASIC. One must learn about the architecture of the computer and all of the instructions which manipulate one or two bytes at a time. Then one must purchase an editor/assembler to use for making

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the assembly language program. An alternative to buying the assembled program is to hand translate the assembly language program to machine code, the actual single-byte codes used by the computer, and use a BASIC program to POKE these codes into memory. Because of these drawbacks, most home computer users stick to BASIC.

There are four techniques which can be used on the Color Computer with Extended BASIC. The first technique is to draw an object using line, draw, circle, paint, or whatever instructions are required for that particular object. Then the object would be erased by repeating the instructions with PRESET to erase the object, followed by redrawing the object in its new location. The second technique uses two alternating display areas. Each area is cleared using PCLS and the object is drawn in its new location. The SCREEN command is issued and all the objects are displayed in their new locations. The third and fourth techniques are to use the GET and PUT commands to erase the object from its old position and place it in a new one. These techniques actually have two rather differing implementations, depending upon the use of the graphics, G, option.

To determine which of these techniques is best, I have written a test program to time them in moving similar objects. The test program compares these four techniques using the computer timer on three cases of different complexity. The first case is a simple line; the second is a stick man made from four lines; the third is a colored box with an inscribed colored circle. Listing 1 presents the test program used for the line test. Listings 2 and 3 present the test program modified for the stick man and colored box.

The test programs all use a PMODE of 3 since that allows the highest graphics resolution with four colors and is the one most games will use. The moving objects progress from the upper left to lower right by incrementing the X and Y positions by one each cycle. Because there are only 128 true X positions out of 256 addressable positions, the object moves horizontally every other cycle but vertically on each cycle. Comments were not put in the code because they affect the running time.

In Listing 1, line 30 draws the initial line and line 40 sets the time to zero to start the timing cycle. Line 50 starts the loop for 150 passes. Line 60 erases the old line and line 70 draws the new line in the next position. When the loop is done, line 90 saves the clock time for display and comparison at the end. For the other animation techniques, a similar process is used. For alternating screens, lines 140 and 160 set up and clear the new screen areas. No specific line erase is needed, only the line drawing in lines 150 and 170.

For the two GET/PUT sequences, array A holds the figure and array B holds the background-only color. Lines 230 and 330 GET the screen data for the arrays which were dimensioned in line 20. The PUT of B in lines 250 and 350 erases the first figure and a PUT of A in lines 260 and 360 displays the figure in its new location. When all four techniques have run, the results are displayed for the total time of each and the ratio to the

smallest time.

Listings 2 and 3 have substituted the stick man and block figures for the simple line. In Listing 2, lines 30 and 35 draw the man as a vertical head and body, left leg, right leg and arms. This pattern is repeated for the erase and redraw functions. The GET and PUT commands are made just large enough to hold the man. In Listing 3, line 30 draws the red box filled in and a circle which is painted blue. The only difference in Listing 3 is that line 60 only needs to draw the box, not the circle, to erase the figure.

The three programs were run with a few strange results. The test timing results are in Figure 1 for all three test cases. It can be seen that the performance varies dramatically. For a simple line, the erase and draw is slightly faster than the GET/PUT methods; and all three are four to five times faster than the alternating screen display. For the stick man, the results change. The plain GET/PUT is fastest; actually three times faster than the erase and redraw, five times faster than the alternating screens; and 20 percent faster than the full graphics GET/PUT. For the block test, the GET/PUT is fastest again by even a larger margin.

Figure 1 — Test Case Timings

Line Test		Time	Ratio
Erase-redraw	236	1	
Alternate screens	1164	4.93	
GET/PUT	245	1.04	
GET/PUT with G.....	250	1.06	
Man Test			
Erase-redraw	922	3.38	
Alternate screens	1500	5.49	
GET/PUT	273	1	
GET/PUT with G.....	342	1.25	
Block Test			
Erase-redraw	1536	4.48	
Alternate screens	2348	6.85	
GET/PUT	343	1	
GET/PUT with G.....	545	1.59	

If you run the test programs you will notice that the plain GET/PUT moves the objects in an erratic manner compared to the other techniques. The object seems to move straight down for three cycles and then takes a large jump to the right while the other techniques move along a diagonal path, taking into consideration the fact that the horizontal position changes only on every other cycle. In the line test, the full graphics GET/PUT starts as a red line but after entering the cycle in lines 340 to 370, a green line is left in the original position and a blue line is moved down the screen. Then, on the block test, a small green dot is left at the corner of the first block. The alternating screens technique does not flicker like the other techniques. This is because the actual object drawing occurs on the page which is not being displayed. There are obvious benefits for this technique if speed is not a requirement.

Why does the GET/PUT work so well? To answer that, I tried to look at the data stored in array A during the stick man test. But, when I printed the first element, A(0,0), the computer responded with BS for a bad subscript. I thought that was a lot of nonsense since A is clearly dimensioned (4,7) in line 20. I tried to print A to see what happened. It worked. That meant that the BASIC program changed the dimensions of our array for its own devious purpose.

To find out what is really in this array, I put the following changes into the man test program:

```
212 FOR I=0 TO 4: FOR J=0 TO 7: A(I,J)=0: NEXT J:
NEXT I
214 P=VARPTR(A(0,0)): Q=P+36 : S$=""
216 FOR I=P TO Q STEP 4
217 ?HEX$(PEEK(I)) S$ HEX$(PEEK(I+1)) S$ HEX$(
PEEK(I+2)) S$ HEX$(PEEK(I+3))
218 NEXT
219 IF INKEY$="" THEN 219
232 FOR I=P TO Q STEP 4
233 ?HEX$(PEEK(I)) S$ HEX$(PEEK(I+1)) S$ HEX$(
PEEK(I+2)) S$ HEX$(PEEK(I+3))
234 NEXT
235 END
```

The result of these two printouts is in Figure 2 along with the result after a full graphics GET. This figure shows the memory location of the array before and after performing the GET commands.

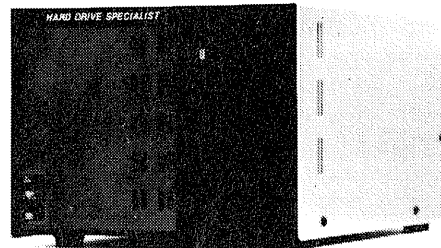
The first line of Figure 2 indicates that there are three arrays. (These were dimensioned in line 20.) The second line gives the name of the first array "A" since a 41 is the ASCII code for A. The third and fourth lines of the before GET indicate that the array has two dimensions with eight and five elements. Then the array contents which we set to zero are listed.

After performing the GET, the name "A" is followed by six zeroes instead of the array description so BASIC no longer considers it an array. That is why we got a bad subscript error when trying to print its contents. It then appears that the array name and description have been copied into lines 5 to 7. Lines 8 and 9 hold the data that the GET has placed in the array. There is a big difference between the data saved by the plain and graphics GET/PUTs.

For the plain GET/PUT, there is one byte stored for each of the eight lines in the GET array. This matches the data used in the page for the screen display. Every two-bit pair represents one pixel with a zero being the background color (white) and a three being the red. If you were to draw a picture of each byte using a blank for background white and an "r" for the red color, it would show a picture of the stick man that we drew. The full graphics GET uses only five bytes to store all of the data. Each bit in the full graphics GET represents one bit from the screen area saved. In this case, because only five X elements were requested in the GET, only five bits were saved for each row. There were two bits saved for each of the first two pixels, but only the most significant bit of the last pixel. Now that we see what is saved by the GET, we can understand how the PUT works.

The reason the PUT works so fast is that the screen image is simply transferred from array memory locations to the screen display page by the machine

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language code in the BASIC ROM. There is no conversion of the data from BASIC floating point format other than the initial array limits. In the plain GET/PUT, the data is handled one byte at a time. In the full graphics GET/PUT, the data is handled one bit at a time. The full graphics allows a more precise operation but takes more time because individual bits are manipulated rather than full bytes.

In the plain GET/PUT test, the object seems to move in a step pattern instead of a straight, diagonal path. If the movement in the horizontal (X) direction were in multiples of eight, there would be no visible difference in the movement between the two GET/PUTs. But for our test, the X direction increments by one. The plain GET/PUT places the object in the same respective byte location on each successive horizontal row until the X value exceeds a multiple of eight. Then the object is moved right by one byte or four pixels.

BASIC determines (from the starting X and Y coordinates) which byte to fill and then starts storing the data from the array. If the X coordinate is zero to seven, the first horizontal byte is used; for eight to fifteen, the second byte, etc. For the full graphics GET/PUT, each bit is placed exactly where the PUT command specifies and it follows the diagonal path down the screen.

Since the full graphics GET/PUT saves one bit for each element specified, it saved five bits for each horizontal row for the stick man, one bit for the line, and eleven bits for the block. When it performed the PUT, five bits, one bit, and eleven bits were placed back in memory for display. In the case of the simple line, the one-bit put a color code of two instead of three on the screen, resulting in a blue line instead of a red one. Since only one bit was used to erase the first image, the second bit remained, producing the green line which has a color code of one. This same effect left the dot in the moving block-test.

Some care must be exercised in using the GET/PUT commands. The following cautions apply to PMODE 3 and similar ones to the other modes. When using the full graphics GET/PUT, there should always be an even number of horizontal pixels. The number of pixels is computed by subtracting the two X values and adding one. For the man test, $14-10+1=5$ is an odd number. Close examination reveals that the right-most arm and leg are actually blue instead of red like the rest of the man. When using the plain GET/PUT, remember that movements of less than eight in the horizontal direction will not really move the object horizontally every time. Careful design can allow the slightly greater speed of this mode if the objects are always at horizontal positions that are multiples of eight.

Following is a hint on how to save memory when using the GET/PUT. The dimension statement reserves five bytes for each element in the array but the GET uses only a small amount of that. To find how much is needed, one must first determine the number of elements in the array. This size is calculated by multiplying the rows by the columns. For a GET of an array such as the man test at (10,10)-(14,17), we get $14-10+1=5$ and $17-10+1=8$. Then we multiply 5×8 for 40 actual elements. For the full graphics GET/PUT, each element

takes one bit, so by dividing by eight, we get five bytes needed. We divide this by five to get the number of array elements which, in this case, is one. Because BASIC is also going to move and save the original data, we add two more elements to be sure we do not overflow the area. A total of three elements in a two-dimensional array can be achieved by a dimension statement of A(0,2). This saves $(40-3) \times 5 = 185$ bytes of memory.

Similarly, for the plain GET/PUT, we can calculate the amount needed. There are always at least eight elements saved for the horizontal dimension, so we round up our horizontal value to a multiple of eight. In this case, five rounds to eight. Then we multiply 8×8 for 64 elements; dividing by eight bits/byte gives us eight; dividing by five bytes/element and rounding up gives us two; adding two extras gives us four so we can dimension A(0,3) to get four elements.

Let's use GET/PUT in a game and see how well it does. The game is Zombies (Listing 4), which is similar to games implemented on other computers under various names. It requires at least 16K RAM and Extended BASIC. The idea is to avoid being caught by a zombie while getting them to fall into the pits.

All arrays are dimensioned in line 10. MX and MY are the zombie coordinates and ZM is a flag word for each zombie to tell if he has fallen into a pit yet. The GET/PUT arrays are P for the player, M for the zombies, PT for the pits and C for clear. Line 20 assures that random numbers are generated. Lines 25 to 47 give the playing directions. Lines 50 to 95 create the four arrays. Line 100 sets a random number of pits for each game. Lines 110 and 115 put a border of pits to restrict play to a fixed screen size. Lines 120 to 127 allow selection of the zombies' movement. Lines 130 to 140 place the pits on the playing area.

The computations in line 135 assure that the pits are located on multiples of six pixels in the X direction and eight in the Y direction. The same equations are used to place the zombies and the player. The zombies and the player also move in increments of six and eight pixels. This computation is critical to correct functioning of the game. Lines 150 to 170 initialize the ZM flag and place the zombies so that they do not start in a pit. Line 145 and lines 180 to 182 select the option for the fast or slow speed.

Some set-up functions are performed while the player is reading the directions. Line 190 sets the computer into a faster processing mode if high speed was selected. Line 200 sets the player position. Line 205 tests the number of jumps left and goes to 410 if all of them are used up. Lines 210 and 215 assure that the player isn't put into a pit or on a zombie and places him on the screen. Line 220 is a delay to allow the player to see the playing area and decide which way to move. Line 225 checks for the key-in. If a key was hit, the player is erased and control goes to 200 for a new jump position. Lines 230 and 255 read the joystick command and lines 260 to 275 move the player. If he moves to an occupied space, control goes to 395 and the game is over. Lines 280 through 340 move the zombies toward the player. Lines 345 to 445 provide the game termination. Line 420 restores the computer speed to normal so that the cassette will function properly after the game.

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TREASURE HUNT — The Lumas caves, located in Lumusville, Vermont, are said to have 20 hidden treasures in them. Few explore the caves because it is said that pirates and dragons live there, and there are deep pits which many have fallen into and died. You, a smart and brave human, and I, an alert computer, will explore the caves and try to find the treasure.

BANKO — The Game is similar to Black Jack. You draw numbers stopping before the total point value exceeds 11. If you go over 11, then your hand will be zeroed. If you draw 5 times without going over 11, then you'll receive bonus points equal to the value of your hand at the time you end your turn.

DOG STAR ADVENTURE® — The evil General Doom and his Roche Soldiers are ready to launch an attack against the forces of freedom lead by Princess Leya. While traveling to her secret command center, Doom attacks Princess Leya's ship. She is now being held prisoner on one of General Doom's battle cruis-

ers. We must try to save the Princess and the treasury of her freedom fighting force.
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The object of a game is to amass treasure for points or accomplish some other goal such as preventing the destruction of the automated nuclear plant in Mission Impossible. Successfully completing a game, however, is far easier to state than achieve. In many cases you will find a treasure but be unable to take it until you are carrying the right combination of objects you find in the various locations.

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The GET/PUT can make a BASIC game fast enough to be challenging because the data is handled similarly to an assembly language program. You must be cautious, however, because of the unusual restrictions due to the data format and handling by BASIC.

Figure 2 — Array Format

Before GET	After GET	After GET with G
3 0 39 1B	3 0 39 1B	3 0 39 1B
0 41 0 0	0 41 0 0	0 41 0 0
D1 2 0 8	0 0 0 0	0 0 0 0
0 5 0 0	42 0 0 0	42 0 0 0
0 0 0 0	0 0 0 41	0 0 0 41
0 0 0 0	0 0 D1 2	0 0 D1 2
0 0 0 0	0 8 0 5	0 8 0 0
0 0 0 0	C C 3F C	31 BE 63 1B
0 0 0 0	C C 33 33	39 0 0 0
0 0 0 0	0 0 0 0	0 0 0 0

Listing 1 — Moving Line Test

```

1 REM MOVING LINE TEST
2 REM ERASE AND REDRAW
5 PCLEAR8:PMODE3,1:COLOR4,1:PCLS:SCREEN1
,1
20 DIMA(1,4),T(3),B(1,4)
30 LINE(10,10)-(10,13),PSET
40 TIMER=0
50 FOR I=10 TO 160
60 LINE(I,I)-(I,I+3),PRESET
70 LINE(I+1,I+1)-(I+1,I+4),PSET
80 NEXT I
90 T(0)=TIMER
100 PCLS
101 REM ALTERNATE PAGES
110 TIMER=0
130 FOR I=10 TO 160 STEP 2
140 PMODE3,5:PCLS
150 LINE(I,I)-(I,I+3),PSET:SCREEN1,1
160 PMODE3,1:PCLS
170 LINE(I+1,I+1)-(I+1,I+4),PSET:SCREEN1
,1
180 NEXT I
190 T(1)=TIMER
200 PCLS:PMODE3,1:SCREEN1,1
201 REM GET AND PUT
210 TIMER=0
220 LINE(10,10)-(10,13),PSET
230 GET(10,10)-(10,13),A:GET(30,30)-(30,
33),B
240 FOR I=10 TO 160
250 PUT(I,I)-(I,I+3),B
260 PUT(I+1,I+1)-(I+1,I+4),A
270 NEXT I
290 T(2)=TIMER

```

```

300 PCLS:PMODE3,1:SCREEN1,1
301 REM GET AND PUT WITH G OPTION
310 TIMER=0
320 LINE(10,10)-(10,13),PSET
330 GET(10,10)-(10,13),A,G:GET(30,30)-(3
0,33),B,G
340 FOR I=10 TO 160
350 PUT(I,I)-(I,I+3),B,PSET
360 PUT(I+1,I+1)-(I+1,I+4),A,PSET
370 NEXT I
390 T(3)=TIMER
400 H=20000:FOR I=0 TO 3
410 IF T(I)<H THEN H=T(I)
420 NEXT I
430 FOR I=0 TO 3
440 PRINT T(I),T(I)/H
450 NEXT
500 END

```

Listing 2 — Moving Man Test

```

1 REM MOVING MAN TEST
2 REM ERASE AND REDRAW
5 PCLEAR8:PMODE3,1:COLOR4,1:PCLS:SCREEN1
,1
20 DIM A(4,7),T(3),B(4,7)
30 LINE(12,10)-(12,14),PSET:LINE-(10,17)
,PSET
35 LINE(12,14)-(14,17),PSET:LINE(10,12)-
(14,12),PSET
40 TIMER=0
50 FOR I=10 TO 160
60 LINE(I+2,I)-(I+2,I+4),PRESET:LINE-(I,
I+7),PSET
65 LINE(I+2,I+4)-(I+4,I+7),PRESET:LINE(I
,I+2)-(I+4,I+2),PRESET
70 LINE(I+3,I+1)-(I+3,I+5),PSET:LINE-(I+
1,I+8),PSET
75 LINE(I+3,I+5)-(I+5,I+8),PSET:LINE(I+1
,I+3)-(I+5,I+3),PSET
80 NEXT I
90 T(0)=TIMER
100 PCLS
101 REM ALTERNATE PAGES
110 TIMER=0
130 FOR I=10 TO 160 STEP 2
140 PMODE3,5:PCLS
150 LINE(I+2,I)-(I+2,I+4),PSET:LINE-(I,I
+7),PSET
155 LINE(I+2,I+4)-(I+4,I+7),PSET:LINE(I,
I+2)-(I+4,I+2),PSET:SCREEN1,1
160 PMODE3,1:PCLS
170 LINE(I+3,I+1)-(I+3,I+5),PSET:LINE-(I
+1,I+8),PSET
175 LINE(I+3,I+5)-(I+5,I+8),PSET:LINE(I+
1,I+3)-(I+5,I+3),PSET:SCREEN1,1

```



```

180 NEXT I
190 T(1)=TIMER
200 PCLS:PMODE3,1:SCREEN1,1
201 REM GET AND PUT
210 TIMER=0
220 LINE(12,10)-(12,14),PSET:LINE-(10,17),PSET
225 LINE(12,14)-(14,17),PSET:LINE(10,12)-(14,12),PSET
230 GET(10,10)-(14,17),A:GET(30,30)-(34,37),B
240 FOR I=10 TO 160
250 PUT(I,I)-(I+4,I+7),B
260 PUT(I+1,I+1)-(I+5,I+8),A
270 NEXT I
290 T(2)=TIMER
300 PCLS:PMODE3,1:SCREEN1,1
301 REM GET AND PUT WITH G OPTION
310 TIMER=0
320 LINE(12,10)-(12,14),PSET:LINE-(10,17),PSET
325 LINE(12,14)-(14,17),PSET:LINE(10,12)-(14,12),PSET
330 GET(10,10)-(14,17),A,G:GET(30,30)-(34,37),B,G
340 FOR I=10 TO 160
350 PUT(I,I)-(I+4,I+7),B,PSET
360 PUT(I+1,I+1)-(I+5,I+8),A,PSET
370 NEXT I
390 T(3)=TIMER
400 H=20000:FOR I=0 TO 3
410 IF T(I)<H THEN H=T(I)
420 NEXT I
430 FOR I=0 TO 3
440 PRINT T(I),T(I)/H
450 NEXT I
500 END

```

Listing 3 — Moving Block Test

```

1 REM MOVING BLOCK TEST
2 REM ERASE AND REDRAW
5 PCLEAR8:PMODE3,1:COLOR4,1:PCLS:SCREEN1,1
20 DIM A(10,10),B(10,10),T(3)
30 LINE(10,10)-(20,20),PSET,BF:CIRCLE(15,15),4,3:PAINT(15,15),3,3
40 TIMER=0
50 FOR I=10 TO 160
60 LINE(I,I)-(I+10,I+10),PRESET,BF
70 LINE(I+1,I+1)-(I+11,I+11),PSET,BF:CIRCLE(I+6,I+6),4,3:PAINT(I+6,I+6),3,3
80 NEXT I
90 T(0)=TIMER
100 PCLS
101 REM ALTERNATE PAGES

```

```

110 TIMER=0
130 FOR I=10 TO 160 STEP 2
140 PMODE3,5:PCLS
150 LINE(I,I)-(I+10,I+10),PSET,BF:CIRCLE(I+5,I+5),4,3
155 PAINT(I+5,I+5),3,3:SCREEN1,1
160 PMODE3,1:PCLS
170 LINE(I+1,I+1)-(I+11,I+11),PSET,BF:CIRCLE(I+5,I+5),4,3
175 PAINT(I+5,I+5),3,3:SCREEN1,1
180 NEXT I
190 T(1)=TIMER
200 PCLS:PMODE3,1:SCREEN1,1
201 REM GET AND PUT
210 TIMER=0
220 LINE(10,10)-(20,20),PSET,BF:CIRCLE(15,15),4,3:PAINT(15,15),3,3
230 GET(10,10)-(20,20),A:GET(30,30)-(40,40),B
240 FOR I=10 TO 160
250 PUT(I,I)-(I+10,I+10),B
260 PUT(I+1,I+1)-(I+11,I+11),A
270 NEXT I
290 T(2)=TIMER
300 PCLS:PMODE3,1:SCREEN1,1
301 REM GET AND PUT WITH G OPTION
310 TIMER=0
320 LINE(10,10)-(20,20),PSET,BF:CIRCLE(15,15),4,3:PAINT(15,15),3,3
330 GET(10,10)-(20,20),A,G:GET(30,30)-(40,40),B,G
340 FOR I=10 TO 160
350 PUT(I,I)-(I+10,I+10),B,PSET
360 PUT(I+1,I+1)-(I+11,I+11),A,PSET
370 NEXT I
390 T(3)=TIMER
400 H=20000:FOR I=0 TO 3
410 IF T(I)<H THEN H=T(I)
420 NEXT I
430 FOR I=0 TO 3
440 PRINT T(I),T(I)/H
450 NEXT I
500 END

```

Listing 4 — Zombie Game

```

1 REM ZOMBIES
2 REM COPYRIGHT 1982
3 REM BY
4 REM DALE H. FAWCETT
5 PCLEAR4
10 DIM MX(14),MY(14),P(4,7),M(4,7),PT(4,7),C(4,7),ZM(14)
15 L=6
20 Z=RND(TIMER):SCREEN1,1
25 CLS:PRINT"ZOMBIES":PRINT"COPYWRITE BY DALE H. FAWCETT"
30 PRINT"THERE ARE 15 RED ZOMBIES TRYING

```


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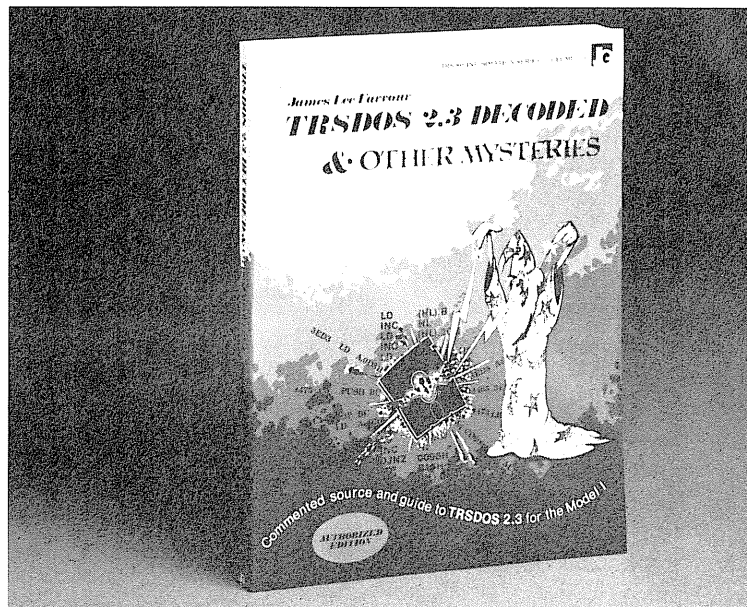
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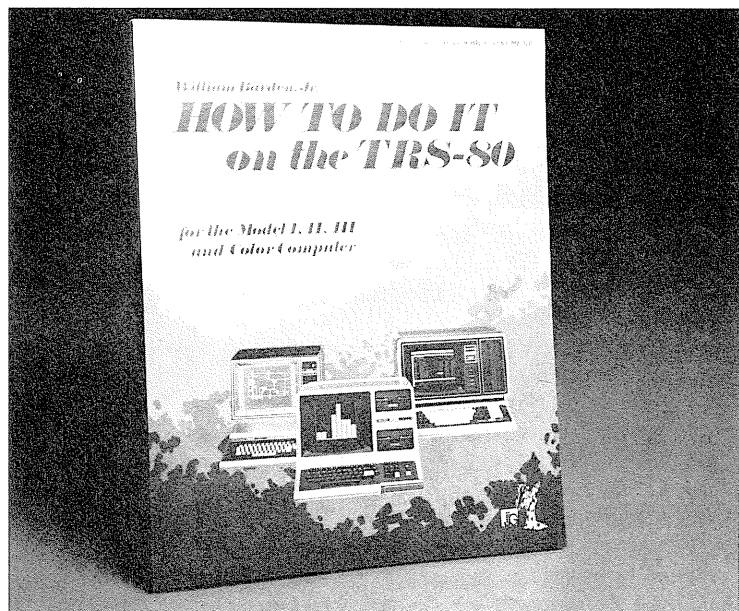
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```

    TO CAPTURE YOU"
35 PRINT"YOU MUST AVOID THEM AND GET THE
M TO FALL INTO THE GREEN PITS"
40 PRINT"USE YOUR JOYSTICK TO MOVE"
45 PRINT"PUSH ANY KEY TO JUMP IF YOU ARE
    SURROUNDED"
47 PRINT"BUT YOU CAN ONLY JUMP 5 TIMES"
50 PMODE3,1:COLOR3,1:PCLS1
55 LINE(128,91)-(128,95),PSET:LINE-(126,
98),PSET
60 LINE(128,95)-(130,98),PSET:LINE(126,9
3)-(130,93),PSET
65 GET(126,91)-(131,98),P,G
70 COLOR4,1
75 LINE(160,91)-(160,95),PSET:LINE-(158,
98),PSET
80 LINE(160,95)-(162,98),PSET:LINE(158,9
3)-(162,93),PSET
85 GET(158,91)-(163,98),M,G
90 COLOR2,1:LINE(100,91)-(105,98),PSET,B
F:GET(100,91)-(105,98),PT,G
95 GET(100,46)-(104,52),C,G
100 PN=RND(13)+2
105 PCLS
110 LINE(0,0)-(5,191),PSET,BF:LINE(0,0)-
(255,7),PSET,BF
115 LINE(0,184)-(255,191),PSET,BF:LINE(2
50,0)-(255,191),PSET,BF
120 PRINT"CHOOSE ZOMBIE MOVEMENT"
122 PRINT"1 MOVE ONLY ONE DIRECTION":PRI
NT"2 MOVE DIAGONALLY"
125 DM$=INKEY$:IF DM$="" THEN 125
127 IF DM$="1"OR DM$="2" THEN 130 ELSE 1
25
130 FOR I=0 TO PN
135 PX=6*INT((RND(222)+12)/6):PY=8*INT((
RND(166)+16)/8)
140 PUT(PX,PY)-(PX+5,PY+7),PT,PSET:NEXTI
145 PRINT"SELECT SPEED 1=HIGH 0=LOW"
150 FOR I=0 TO 14:ZM(I)=1
155 MX(I)=6*INT((RND(222)+12)/6):MY(I)=8
*INT((RND(166)+16)/8)
160 IF PPOINT(MX(I),MY(I)+2)<>5 THEN 155
165 PUT(MX(I),MY(I))-(MX(I)+5,MY(I)+7),M
,PSET
170 NEXT
175 Z=14
180 SP$=INKEY$:IF SP$="" THEN 180
182 IF SP$="0" OR SP$="1" THEN 185 ELSE
180
185 CLS
190 IF SP$="1" THEN POKE 65495,0
195 SCREEN1,1
200 X=6*INT((RND(222)+12)/6):Y=8*INT((RN
D(166)+16)/8)
205 L=L-1:IF L<0 THEN 410
210 IF PPOINT(X,Y+2)<>5 THEN 200
215 PUT(X,Y)-(X+5,Y+7),P,PSET
220 FOR I=1 TO 1000:NEXT
225 IF INKEY$="" THEN 230 ELSE PUT(X,Y)-
(X+5,Y+8),C,PSET:GOTO200
230 XV=0:V=JOYSTK(0)
235 IF V<5 THEN XV=-6
240 IF V>58 THEN XV=6
245 YV=0:V=JOYSTK(1)
250 IF V<5 THEN YV=-8
255 IF V>58 THEN YV=8
260 PUT(X,Y)-(X+4,Y+7),C,PSET
265 X=X+XV:Y=Y+YV
270 IF PPOINT(X,Y+2)<>5 THEN 395
275 PUT(X,Y)-(X+5,Y+7),P,PSET
280 FOR I=0 TO 14:IFZM(I)=0 THEN 340
285 PUT(MX(I),MY(I))-(MX(I)+5,MY(I)+7),C
,PSET
290 IF(DM$="1"AND MY(I)<>Y) THEN ON RND(
2) GOTO 295,305
295 IF MX(I)<X THEN MX(I)=MX(I)+6:IFDM$=
"1" THEN 315
300 IF MX(I)>X THEN MX(I)=MX(I)-6:IF DM$
="1" THEN 315
305 IF MY(I)<Y THEN MY(I)=MY(I)+8
310 IF MY(I)>Y THEN MY(I)=MY(I)-8
315 IF PPOINT(MX(I),MY(I)+2)<>5 THEN 330
320 PUT(MX(I),MY(I))-(MX(I)+5,MY(I)+7),M
,PSET
325 GOTO 340
330 IF PPOINT(MX(I),MY(I)+2)=7 THEN 365
335 IF PPOINT(MX(I),MY(I)+2)=6 THEN ZM(I
)=0:Z=Z-1:SOUND20,1
340 NEXT I
345 IF Z<0 THEN 355
350 GOTO 225
355 PRINT"YOU WIN"
360 GOTO 420
365 FOR Q=1 TO 20:SOUND150,1
370 PUT(X,Y)-(X+5,Y+7),M,PSET
375 PUT(X,Y)-(X+5,Y+7),P,PSET
380 NEXT Q
385 PRINT"YOU WERE CAUGHT"
390 GOTO 420
395 IF PPOINT(X,Y+2)<>6 THEN 365
400 PRINT"YOU CLUMSY OAF":PRINT"YOU HAVE
    FALLEN INTO A PIT"
405 GOTO 420
410 PRINT"YOUR LAST JUMP PUT YOU IN A PI
T":PRINT"LOOK BEFORE YOU LEAP"
415 GOTO 420
420 POKE 65494,0
425 PRINT"DO YOU WANT TO PLAY AGAIN (Y/N
)"
430 AS=INKEY$
435 AS=INKEY$:IF AS$="" THEN 435
440 IF AS<>"Y" THEN END
445 RESTORE:GOTO 5

```




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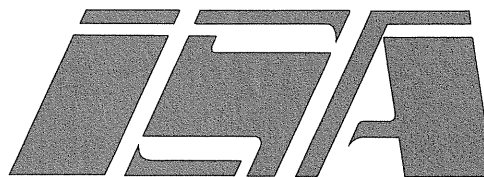
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Exploring VisiCalc

Looking at @ LOOKUP

Models I/II/III

Timothy K. Bowman, Spokane, WA

This month, let's take a look at another very powerful VisiCalc function. Model I VisiCalc users should become especially familiar with the @LOOKUP function because of its logic-testing ability. But that's jumping the gun. Let's first review the basic requirements

for the use of the @LOOKUP function.

The @LOOKUP function looks up a value in a table and, based upon what is contained in that table, brings back a result. Three arguments are required to use the function. For example, study the

@LOOKUP function found in position E5 of Figure 1 (@LOOKUP (D5,A14...F14). The value at D5 is compared to a range of values found in the cells from A14 to F14. When the program finds a value that exceeds the value at D5, or when it reaches the end of the table, it takes

Figure 1

	A	B	C	Column D	E	F	G
1				"Sample Co	"mpany		
2				"	Invoi	"ce	
3							
4		"Descripti	"on	"Quantity	" Price	"Extension	
R 5		"Wigit 1		100	/F\$@LOOKUP	/F\$+D5*E5	
O					(D5,A14...		
W					F14		
6		"Wigit 2		99	/F\$@LOOKUP	/F\$+D6*E6	
					(D6,A14...		
7		"Wigit 3		1	/F\$@LOOKUP	/F\$+D7*E7	
					(D7,A14...		
8			"Subtotal		F14		
						@SUM(F5...	
9				"Tax		F7	
						/F\$@LOOKUP	
						(F8,B17...	
10			"Total			C17)*F8	
						/F\$@SUM(F8	
11						...F9	
12						"	=====
13	"Table 1						
14	1	5	25	50	100	200	
15	2.98	2.5	2.4	2.3	2	1.95	
16							
17	"Table 2						
18		200	300				
19		.05	.07				

the value found immediately below and to the left of that higher value in the table.

In our example in Figure 1, wig it 1 has a quantity of 100. Based upon that quantity, the price per unit should be \$2.00. The @LOOKUP function scans the table for the quantity which exceeds 100; which is 200. It then takes the entry in E15 as the price for a quantity of 100, which is \$2.00 each. Similarly, wig it 2 has a quantity of 99 and its price is \$2.30; wig it 3 has a quantity of 1 with a price of \$2.98. Type in the sample invoice in Figure 1 and experiment with various quantities to test the pricing.

You'll note the format of the listing is different from my previous articles. It was produced with a program called the VC Formula Printer which is available from The Alternate Source, 704 N. Pennsylvania Ave., Lansing, MI 48906, (517) 482-8270. (\$39.95, Models I/III-Ed.) I think you'll find future listings in "Exploring VisiCalc" much easier to read.

You might also note that the sample invoice contains two @LOOKUP tables. The second table is a possible tax table that compares the invoice total to a table. If the invoice total exceeds \$200, the tax rate goes up to seven percent; otherwise the rate is five percent. In practice, you can have as many @LOOKUP tables in your program as you wish. For our simple invoice we could have created separate @LOOKUP tables for each of the wig it types in order to have separate pricing structures. All you need to do is provide the search value and the location of the table.

Other Considerations

While the table in the above example was constructed in rows from left to right, it could just as easily have been constructed in vertical columns. That is, as long as the values resulting from the search (\$2.98 to \$1.95) were located in the column found immediately to the right of the search column. You'll have to develop your own style for which direction is best in your applications. I do recommend that the tables be constructed on the left side of the screen for ease of use, faster operation, and memory

conservation. Technically, the tables are forward references, however, the values do not change, so that should not present a problem.

Here are three other hints for the successful use of @LOOKUP. First, if there is a possibility that your program will calculate a zero answer that will be used later in a division calculation, use @LOOKUP to convert that result to one. This will help eliminate getting error messages during the recalculation of your spreadsheet.

The credit for this goes to a reader in Texas. In order to conserve memory and simplify table construction, add, subtract, multiply, or divide the search value by a constant or some other number. For example, using our invoice problem, assume that we have another product that has the same prices but that they vary on quantities of 5, 25, 125, 250, 500, and 1000. Simply divide the search value by five and search the LOOKUP table starting at E14. This will correctly price the items for different search quantity values and also save considerable memory.

Lastly, this one is for Model I and II users. You can create an approximation of the enhanced version of VisiCalc's @TRUE function. Construct an @LOOKUP table that will test whether a number in position A2 is positive or not. If the number is positive, have the program insert a one before the word TRUE in position A3 and a zero before the word FALSE in position A4. If the number is negative, opposite values should be inserted. For a hint, see the solutions to the February Puzzler which were in the April, 1983 issue of 80-U.S. Journal. With this simple truth table your program can now test logic conditions. You could even split the screen so that the true/false output is in a different screen. If you want a listing of a solution to this problem, have a favorite @LOOKUP application, or questions concerning VisiCalc, write to me in care of 80-U.S. Journal. Please enclose a stamped, self-addressed envelope if you desire a reply.

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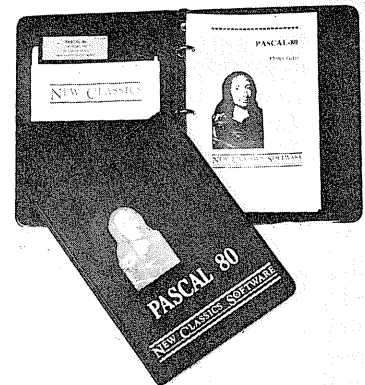
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How do the modems do it and a downloading tip

Donald L. Stoner, Mercer Island, WA

As mentioned in a previous column, the RS-232 circuitry in your computer serializes the parallel eight-bit words and feeds the data to the modem. Through the process called "modulation", the modem converts the ones and zeros into specific tones that can be sent through the telephone network.

Fortunately, the tones used by either an acoustic or direct-connect modem are standardized so that the two types of modems can "talk" to each other. The resting state of the serial line (when no data is being sent) represents a constant "one." This steady state, or constant "one," from the computer is represented by a tone frequency of 1270 cycles per second (or Hertz, which is abbreviated as Hz.).

Radio amateurs often refer to this as the marking state. A bit is usually called a pulse. Thus, in ham radio circles, a one is called a mark pulse.

The start bit is always a zero and generates a tone of 1070 Hz., as does any zero data bit. Hams refer to this as the space pulse. These two frequencies are called the low-band tone pair. The tones toggle back and forth between these two frequencies, in step with the data stream of 1's and 0's from the computer. Radio amateurs use a mark, or one, frequency of 2125 Hz. and a space, or zero, frequency of 2295 Hz. Thus, the frequency shift amounts to 170 Hz. Whether one is talking about the telephone or ham radio communications, the scheme just described is called frequency shift keying (FSK).

It is usually necessary for computers to communicate in both directions. Unlike ham communications, it is also very desirable that they be able to do so simultaneously, just the way humans beings talk on

the telephone.

Obviously, two computers cannot use the same tones at the same time. No matter how smart your TRS-80 is, it cannot tell its own 1's and 0's from the other computer's 1's and 0's if the same frequencies are used.

The problem is solved on the telephone network by using another pair of tones for a second channel. The second, or back channel, uses 2225 Hz. for ones and 2025 Hz. for zeros. These tones are called the high-band tone pair. The shift between ones and zeros amounts to exactly 200 Hz. A typical communications link between two computers would look like Figure 1.

Full Duplex

The arrangement shown in Figure 1 allows both computers to send and receive at the same time. This is desirable if you want to interrupt or change what the other computer is doing, without waiting for it to finish its current task.

This system also allows echos to be returned to you. Echos? Who needs echos? Let's say you (computer A) send the word "hello" to the other computer (computer B). It recognizes the changing one and zero tones as a series of letters that comprise the word "hello". This word is displayed on the screen of computer B. At the same time, the remote computer (B) converts the 1's and 0's back into tones on the high-band tone pair. These tones are sent back, or echoed, to you. Your modem converts these tones back to 1's and 0's and displays the word "hello" on your screen.

The round trip, from A to B and back to A, occurs almost instantaneously. The actual time

depends on the length of the telephone line, but typically is in the order of 50 milliseconds. The "echo" character seems to appear on your screen as soon as you press the key. The important point is this: what you see is what the other computer received. If you do not see the letter representing the key you pressed, the transmission is said to be garbled. It indicates a defective telephone circuit or equipment problems. This scheme is called full duplex and provides an excellent means of visual error detection.

Half Duplex

Instead of a computer, let's say your end of the link was a mechanical printer and keyboard, such as a TeletypeTM machine. Many universities and colleges still use these terminals so students can communicate with a central time-sharing computer (a computer with many simultaneous users). When you type the word "hello", your modem sends out the tones representing the word, but the Teletype machine also prints the word on paper. If the word were also echoed back to you (full duplex), the word would be printed on the paper a second time. Actually, the echoes are returned before you can type the next letter. Thus, you would see something like "hheelllloo" on the printout. Any data you send would show as a series of double letters. Systems that avoid this problem do not return echoes and are called half duplex.

Answer/Originate Modes

One of the most confusing terms (and one of the hardest to explain) is answer and originate and what "originate only" means. Let's say

you (computer A) and another (computer B) are both talking to a time-sharing or host system such as CompuServe or The Source. The communications link would look like the diagram in Figure 2.

This is a common type of communications link. Depending on the number of ports (input channels), literally dozens of computers can "talk" to the host computer at the same time. Computers A and B are both operating in the originate mode. This means nothing more than they are sending to the host computer (and the host is receiving) on the low-band tone pair. Conversely, the host is sending (computers A and B are receiving) the high-band tone pair. The terms originate and answer have absolutely nothing to do with who originates the call or who answers it!

Now, let's say computer A dials up computer B, rather than the host computer. Figure 3 shows the way the communications line between A and B would be established. As you can see, A is sending the low-band tone pair to B, but B wants to receive the high-band tone pair. By the same token, B is sending the low-band tone pair to A, but A wants to receive the high-band tone pair. It's like inserting a round peg in a square hole and vice versa. It won't work.

Obviously, something has to give! The solution is relatively simple. Either A or B flips a switch on the modem to a position labeled Answer. This exchanges the sending tone pair with the frequencies normally used for the receiving tone pair (and vice versa). Thus the high-band tone pair is transmitted and the low-band tone pair is received. Figure 4 shows this revised communications link.

Communications can now be established. Whichever computer flipped the switch to reverse the tone pairs (in Figure 4 it was B) is now said to be in answer mode. It's as simple as that.

Originate Only

Some modems, in an effort to reduce cost, do not provide the answer mode. This does not cause any problems if the modem is always connected to a system that is set up to receive the originate mode.

By convention, data bases, such as CompuServe and The Source, are almost universally set up in the answer mode to communicate with originate modems. The same is true if an originate-only modem is "talking" to another computer that can switch between originate and answer modes. The only time problems will arise with an originate-only modem is in trying to communicate with another originate-only modem.

Software

For your TRS-80 to spring to life on the telephone network, it will require suitable software. There are two different types. Terminal software allows you to be the originating computer and to contact data bases or other computers. There are two variations of terminal software, called "smart" and "dumb".

The dumb terminal program is exactly that. It allows you to communicate by means of the keyboard and that is about all. There are minor variations, of course. Some will allow you to turn your printer on and off to capture incoming information on paper. Others are dumber than dumb and do not even provide this level of sophistication.

Smart terminal programs will permit you to send cassette or disk files. They will also allow you to capture incoming data (in the computer memory) and later save it on disk to cassette media. This is called uploading and downloading, respectively. There are numerous smart terminal programs, with varying levels of sophistication and price tags to match.

A Hint on Downloading

That's enough of the "heavy stuff" for this issue. Let's talk about a problem that has plagued everyone who has ever tried to download a program. You examine the menu and there it is... the neatest TRS-80 program you've ever seen... and for free. You fire up your smart terminal program, begin the download, save the program to disk, and they try to load it. The disk whirs a few revolutions and then that infamous phrase **DIRECT STATEMENT IN FILE** appears on your screen. What

do you do then? Try another download, right? Wrong!

When this happens to you, log off the BBS and dig out your copy of *Scriptit*. (*Any word processing program will work* -Ed.) Load the downloaded program into your TRS-80 just the same as if it were a *Scriptit* file. By Jove, there it is, almost the same as if you had typed it in. Start the reconstruction by editing out any garbage. The first character of the file should be the initial digit of the lowest linenumber. There should be no carriage return or linefeeds ahead of this line. These will show up on your screen as a block or arrow, depending on your model's upper/lowercase conversion and version of *Scriptit*.

Next, examine the program, line by line. There should be no lines of data without linenumbers. There should be no carriage returns other than at the end of each program line. If it is a packed program with lots of stuff in one line and no spaces, don't worry if there is a big gap after the linenumber. This is caused by the screen wrap-around in *Scriptit*. The line instructions will function correctly.

Finally, look at the end of the program. There should be nothing following the carriage return after the last line of the program. Edit out "READY", "OK", "Do you want to download another program?", or anything else that appears after the last line of the program.

Resave the *Scriptit* file under the A, or ASCII, format. Exit *Scriptit* and try loading the program. Chances are it will now load and list. You may still see a direct statement error, but this time it may stop before the end of the program. If this happens, note the line number. Reload the program into *Scriptit* and carefully examine the data in the line you noted. You will probably find an embedded carriage return or some other problem.

Once you are able to load the program without error, it will run even though it was saved in ASCII. Make sure there are no bugs and that the program functions properly. Save it as you normally would. It does not have to be saved in ASCII once the editing and cleanup is complete.

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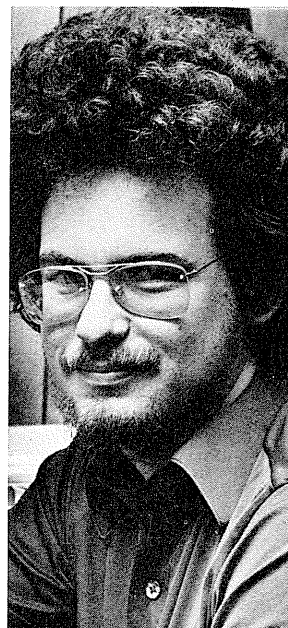
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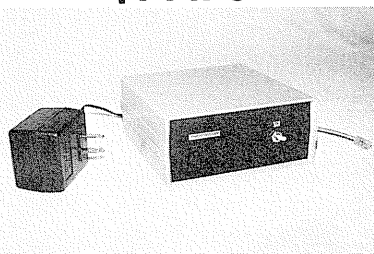
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retrieve messages, download data and programs, and even order products with their credit card.

If you have a modem and would like a comprehensive list of bulletin board numbers, I suggest you call SEACOM-80. This fine BBS, run by Dick Keller, can be reached by dialing 206/763-8879. When you get to the main menu, select "O" for other systems.

Until next time . . . keep on telecommunicating!

Figure 1

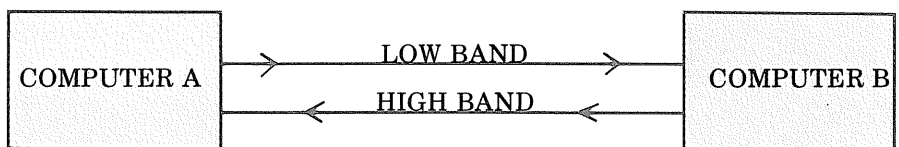


Figure 2

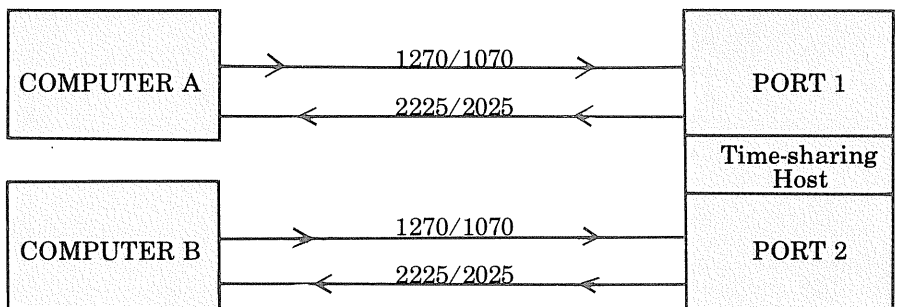


Figure 3

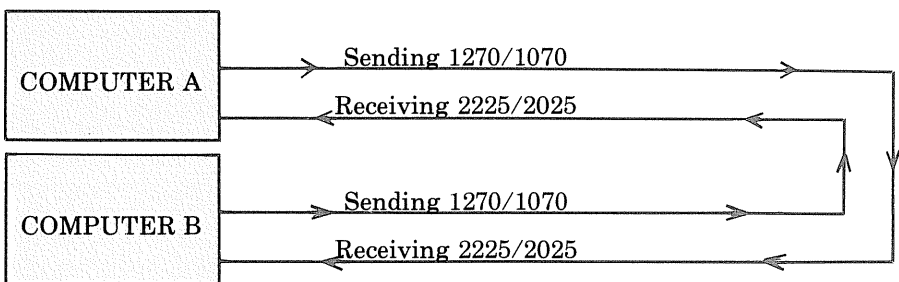
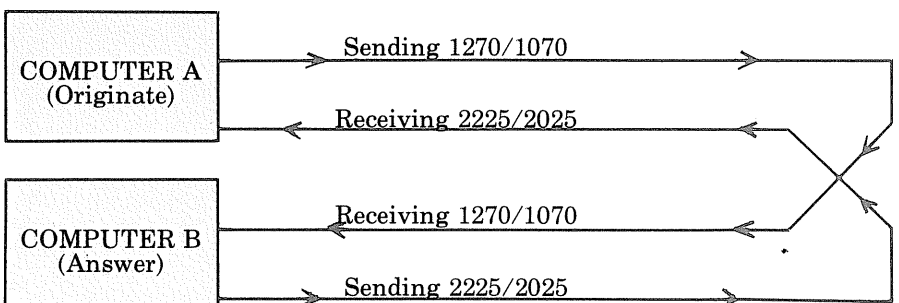


Figure 4





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Zeroes

Using iteration

to solve

single-variable

equations

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G. A. Findlay, Christchurch, New Zealand

Zeroes is a program, written in Level II BASIC, which solves equations numerically. The intention of the algorithm is to (virtually) guarantee convergence, and to indicate the accuracy of its solution. It has been claimed that the algorithm always converges (for suitable starting values). The author is unable to test the claim. Although the algorithm is well known, and has been published in various places, it is not easy to follow and I have not seen a BASIC implementation.

Zeroes solves equations numerically with efficiency and numerical accuracy (avoiding round-off and other errors due to floating point arithmetic) as its criteria. Also, the accuracy of the solution found should be as great as possible and reported to the user.

The program is in two parts. The first (lines 110 to 180) prompts the user; the second does the actual work.

The equation to be solved must be written in the form $f(x)=0$. For example, to solve $x^2 + x = 1$, rearrange the equation as: $x^2 + x - 1 = 0$.

The actual steps involved in using the program are: Load the program. Enter the equation to be solved as lines 190 to 199. This subroutine must be self-contained and determine F for a given X. For the equation above, 190 F = X * X + X - 1 would be suitable. Then, RUN220.

Answer the questions as they are asked: Single or double precision required? Enter two numbers bracketing the root. If unknown, guess wide! Select a tolerance. The actual accuracy attained depends on the tolerance given, the size of the root, and the characteristics of the machine arithmetic. For the maximum attainable accuracy, set the tolerance to 0.0. Give the maximum number of iterations permitted, up to 32767. Indicate whether you want to see all the iterations, or just the answer. The program calculates the root, displays it and its maximum error.

It is impossible in any computer program to completely eliminate all errors due to floating point arithmetic. You should always substitute the root given by the program back into the equation as a check.

On some occasions, the program reports that it has not found convergence, because it is oscillating between two very close approximations. In this case, run the program again with a display of all the iterates — you will soon spot the solution.

For the mathematically minded, the program works by choosing the next iterate from two possible candidates — that obtained by bisection, and that obtained by interpolation (either inverse quadratic or linear interpolation). The actual choice depends on the conditions. Calculations are arranged to minimize error propagation.

Listing 1 — Zeroes

```
10 *****ZEROES*****
20 '*  NUMERICAL SOLUTION  *
```



```

30 '*      OF EQUATIONS      *
40 '* CONVERGES, WITH BEST  *
50 '*      POSSIBLE ACCURACY. *
60 '*      *                  *
70 '*      G. A. FINDLAY,    *
80 '*      87 SOMERFIELD STREET *
90 '*CHRISTCHURCH, NEW ZEALAND
100 '******
110 CLS: CLEAR 300
120 PRINT STRING$(63,191)
130 A$=CHR$(191)+STRING$(61,32)+CHR$(191)
)
140 PRINTA$: PRINTCHR$(191)+STRING$(15,3
2); "INPUT EQUATION TO BE SOLVED AS"; STRI
NG$(16,32); CHR$(191)
150 PRINTCHR$(191)+STRING$(20,32); "190 F
=<FUNCTION OF X>"; STRING$(20,32); CHR$(19
1)
160 PRINTCHR$(191)+STRING$(23,32); "THEN
'RUN 220' "; STRING$(23,32); CHR$(191)
170 PRINTA$: PRINTSTRING$(63,191)
180 END
190 CLS:PRINT"YOU FORGOT THE EQUATION!":
END
200 ITER=ITER+1
210 RETURN
220 CLS:PRINT@0, "SOLUTION OF EQUATION NU

```

```

MERICALY."+CHR$(31)
230 PRINT@64, "SINGLE OR DOUBLE PRECISION
(1 OR 2)"; :INPUT A$
240 IF A$<>"1" AND A$<>"2" THEN 230
250 ON VAL(A$) GOTO 260,280
260 DEFSNG A-Z
270 GOTO 290
280 DEFDBL A-Z
290 EPS=1.0
300 IF 1+EPS>1 THEN EPS=EPS*0.5:GOTO 300
310 PRINT@192, "INPUT INTERVAL CONTAINING
ROOT"; CHR$(30); :INPUT AX, BX
320 ITER=0
330 A=AX: B=BX: X=A: GOSUB 190: FA=F: X=B: GOS
UB 190: FB=F
340 PRINT@256, "INPUT TOLERANCE (>=0.0)";
CHR$(30); :INPUT TL
350 IF TL <0.0 THEN 340
360 PRINT@320, "DO YOU WANT TO SEE EVERY
ITERATE"; :INPUT A$
370 A$=LEFT$(A$,1)
380 PRINT @384, "MAXIMUM ITERATIONS"; :INP
UT MAX%
390 C=A: FC=FA: D=B-A: E=D
400 IF ABS(FC) >= ABS(FB) THEN 420
410 A=B: B=C: C=A: FA=FB: FB=FC: FC=FA
420 IF A$="Y" THEN PRINT B;

```

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rarely used file does Hexman need to move it in from the Library. Thus as Hexman becomes familiar with your pattern of file usage, transfers from the Library drop to a minimum.

Each morning, when you first use Hexman, it scans your Filestore, notes any changes and takes action. Any new files are automatically cataloged. New and updated files are backed up to the Library. Hexman makes this easy to do by sorting the files into Library disk sequence, then prompting you to insert the appropriate Library disks one after the other. This Filestore scan and backup process ensures that your disk Library files match the active files in your Filestore. Thus you can safely treat the few Filestore disks in your drives as if they contained your whole disk Library.

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```

430 IF ITER > MAX%+2 THEN 710
440 T1=2.0*EPS*ABS(B)+0.5*TL
450 XM=0.5*(C-B):IF ABS(XM) <= T1 THEN 660
460 IF FB=0.0 THEN 660
470 IF ABS(E) < T1 THEN 590
480 IF ABS(FA) <= ABS(FB) THEN 590
490 IF A <> C THEN 510
500 S=FB/FA : P=2.0*XM*S : Q=1.0-S : GOT
O 540
510 Q=FA/FC : R=FB/FC : S=FB/FA
520 P=S*(2.0*XM*Q*(Q-R) - (B-A)*(R-1))
530 Q=(Q-1.0)*(R-1.0)*(S-1.0)
540 IF P > 0.0 THEN Q=-Q
550 P=ABS(P)
560 IF (P+P) >= (3.0*XM*Q-ABS(T1*Q)) THE
N 590
570 IF P >= ABS(0.5*E*Q) GOTO 590
580 E=D :D=P/Q:GOTO 600
590 D=XM:E=D
600 A=B:FA=FB
610 IF ABS(D) > T1 THEN B=B+D ELSE B=B+A
BS(T1)*SGN(XM)
620 X=B:GOSUB 190:FB=F
630 IF FB*(FC/ABS(FC)) > 0.0 THEN 390
640 GOTO 400
650 ' ANSWER IS B

```

```

660 PRINT@63,CHR$(31);
670 PRINT@128,"APPROX SOLUTION IS:";B
680 PRINT@256,"THIS IS OF MAXIMUM ERROR"
; CSNG(TL+4*EPS*ABS(B))
690 PRINT @320,"WITH";ITER;"ITERATIONS R
EQUIRED";
700 END
710 PRINT@128,"NO SOLUTION IN ";MAX%;"IT
ERATIONS":END

```

Zeroes — Color Computer Listing

```

10 REM CONVERTED FOR THE COLOR
20 REM COMPUTER BY DON SCARBERRY
130 CLS: CLEAR 300
140 PRINT"INPUT EQUATION TO BE SOLVED AS
"
150 PRINT"190 F=<FUNCTION OF X>"
160 PRINT"THEN RUN 220"
180 END
190 F=X*X-5*X+6
200 ITER=ITER+1
210 RETURN
220 CLS:PRINT"NUMERICAL SOLUTION OF EQUA
TIONS"
230 GOTO 290

```

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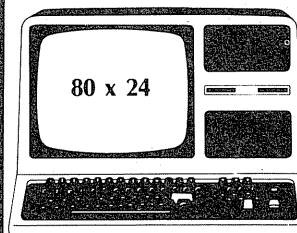
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```


290 EPS=1.0
300 IF 1+EPS>1 THEN EPS=EPS*.5:GOTO 300
310 PRINT"INPUT INTERVAL CONTAINING ROOT
";:INPUT AX,BX
320 ITER=0
330 A=AX:B=BX:X=A:GOSUB 190:FA=F:X=B:GOS
UB 190:FB=F
340 PRINT"INPUT TOLERANCE (>=0) ";:INPUT
TL
350 IF TL<0 THEN 340
360 PRINT"DO YOU WANT TO SEE EVERY ITERA
TE";:INPUT AS
370 AS=LEFT$(AS,1)
380 PRINT"MAXIMUM ITERATIONS ";:INPUT MA
X
390 C=A:FC=FA:D=B-A:E=D
400 IF ABS(FC)>=ABS(FB) THEN 420
410 A=B:B=C:C=A:FA=FB:FB=FC:FC=FA
420 IF AS="Y" THEN PRINT B
425 INPUT"PRESS ENTER TO CONTINUE";EN
430 IF ITER>MAX+2 THEN 710
440 T1=2*EPS*ABS(B)+.5*TL
450 XM=.5*(C-B):IF ABS(XM)<=T1 THEN 660
460 IF FB=0 THEN 660
470 IF ABS(E)<T1 THEN 590
480 IF ABS(FA)<=ABS(FB) THEN 590
490 IF A<>C THEN 510

```

```

500 S=FB/FA:P=2*XM*S:Q=1-S:GOTO 540
510 Q=FA/FC:R=FB/FC:S=FB/FA
520 P=S*(2*XM*Q*(Q-R)-(B-A)*(R-1))
530 Q=(Q-1)*(R-1)*(S-1)
540 IF P>0 THEN Q=-Q
550 P=ABS(P)
560 IF (P+P)>=(3*XM*Q-ABS(T1*Q)) THEN 59
0
570 IF P>=ABS(.5*E*Q) THEN GOTO 590
580 E=D:D=P/Q:GOTO 600
590 D=XM:E=D
600 A=B:FA=FB
610 IF ABS(D)>T1 THEN B=B+D ELSE B=B+ABS
(T1)*SGN(XM)
620 X=B:GOSUB 190:FB=F
630 IF FB*(FC/ABS(FC))>0 THEN 390
640 GOTO 400
650 REM ANSWER IS B
660 GOTO 670
670 PRINT"APPROX SOLUTION IS: ";B
680 PRINT"THIS IS OF MAX. ERROR "
685 PRINT(TL+4*EPS*ABS(B))
690 PRINT"WITH ";ITER;" ITERATIONS REQD.
";
700 END
710 PRINT"NO SOLUTION IN ";MAX;" ITERATI
ONS":END

```



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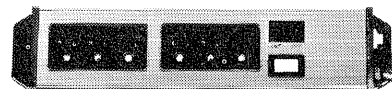
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Basically BASIC

Inside nested loops

For all models

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Last month, we examined FOR...NEXT loops. This month we'll look at nested FOR...NEXT loops. Nested FOR...NEXT loops consist of one loop inside another. Their operation is easy to understand if you keep track of the value of each index variable at each step of the program's execution. We'll start with a relatively simple example:

```
10 REM NESTED LOOPS
20 FOR X = 1 TO 3
30   FOR Y = 1 TO 4
40     PRINT "WHILE X IS ";X,"
Y IS ";Y
50   NEXT Y
60 NEXT X
```

Can you see from the printout on the screen that the Y loop (called the "inside" loop) in lines 30 and 50 executes four times for each execution of the X ("outside") loop in lines 20 and 60? Trace the program's execution on a sheet of paper, keeping track of the value of the index variables X and Y.

Line 20 initializes the value of X as 1. Line 30 then initializes counter Y as 1. Line 40 prints the messages in the quotation marks and the current values of X and Y. Line 50 increments variable Y to 2 and tests if it exceeds its final value of 4 (from line 30). It doesn't, so program control returns to line 40 (the line following the "FOR Y . . . " statement). Line 40 again prints the messages and the current values of X and Y (1 and 2).

The program continues looping

from line 50 to line 40, incrementing Y in line 50 and printing the new value of Y from line 40. X remains equal to 1 while the Y loop executes. Finally, Y is incremented to 5, is tested against its final value of 4, and program control "falls through" to line 60.

Line 60 increments X to 2, tests it against its final value of 3, and passes control to the line following the "FOR X . . ." statement. This is line 30 which initializes a new Y loop. While the value of X is 2, the Y loop executes four times, just as it did when the value of X was 1.

When the value of Y reaches 5, program control again falls through. X is incremented to 3, and a new Y loop begins. It's pretty simple, isn't it? For each time the outside X loop operates once, the inside Y loop will operate completely.

A quick test: When the program finishes running, what are the ending values of X and Y? If you didn't answer four and five, you'd better loop back to last month's Basically BASIC.

Working with Arrays

The main use of nested loops is working with the data in multiple dimension arrays. Don't worry if you don't understand a lot about arrays. We'll diagram the one we are using.

See Figure 1 for the array we are setting up. The values in the array boxes (or array cells), represent the

row number in their first digit and their column numbers in the second digit. So, row 1, column 1 contains the number 11, and row 3, column 4 contains the number 34. Here's a routine to put these values in their appropriate cells in the array. We'll use the variable R to designate the row number and C for the column number. If you have trouble understanding what's happening, just enter these lines -- it's easier to see how the loops work when you print out the contents of the cells (lines 200 to 250).

```
10 REM DIMension array A, 3
rows x 5 columns
20 DIM A(3,5)
100 REM Assign values to array
cells
110 FOR R = 1 TO 3
120   FOR C = 1 TO 5
130     LET A(R,C) = R*10 + C
140   NEXT C
150 NEXT R
```

Reading the Array

The computer's memory now has the values stored in an array named A, as diagrammed in figure 1. Let's write a routine to print these values:

```
200 REM Print values row by
column
210 FOR R = 1 TO 3
220   FOR C = 1 TO 5
230     PRINT A(R,C);
240   NEXT C
250 NEXT R
```

This module prints a solid row of numbers across the screen,

beginning with the number 11 from row 1, column 1; then 12 from row 1, column 2; then 13 . . . The trailing semicolon in line 230 suppresses the carriage return so the numbers print immediately following each other.

Figure 1

		Columns				
		1	2	3	4	5
Rows	1	11	12	13	14	15
	2	21	22	23	24	25
	3	31	32	33	34	35

Can you see what's happening? Line 210 initializes the row counter, R, with a value of 1. Then line 220 sets the column counter, C, to 1. The parentheses following the name of the array, A, in line 230 designate the row and column to be printed. At the beginning of the first pass R and C both equal one, so the contents of array cell A(1,1) (i.e., row 1, column 1) is printed.

The program proceeds to line 240 where the NEXT C statement increments the column counter to 2 and, remaining in the C loop, returns to line 230. The value of R is still one. Line 230 now prints 12, the value of row 1, column 2.

The program continues to loop between line 240, which increments the column counter, and line 230, which prints out the value of the next column entry. When the value of row 1, column 5 (15) has been printed, line 240 increments C once again, this time to six. It tests to see if this exceeds the final value of five. Since six is greater than five, the C loop is completed and program execution falls through to the next line.

Line 250, NEXT R, increments variable R, the row counter, and loops back to line 220. The values of counters R and C at this point (before line 220 executes) are two and six. Program control is now at line 220. Do you remember what happens when a FOR statement executes? The control variable, in

this case, C, is reset to the initial value. We are into a new C loop. While R equals 2, this C loop will again count from 1 to 5.

Now is a good time to slightly revise the program. Add " "; to the end of line 230. This will print a space between the numbers. Add line 245 PRINT. What will this do and why? Why position a PRINT statement between the C and R loops? (You have to figure it out. I'm not going to say.) Trace the program's progress through the loops and jot down on a sheet of paper what line 230 will print on each pass. As a hint, line 245 prints a blank line, called a linefeed or carriage return.

Were you able to predict correctly what the program printed on the screen? If so, congratulations, you have mastered one of the most difficult topics for beginning programmers. The next module should be easy.

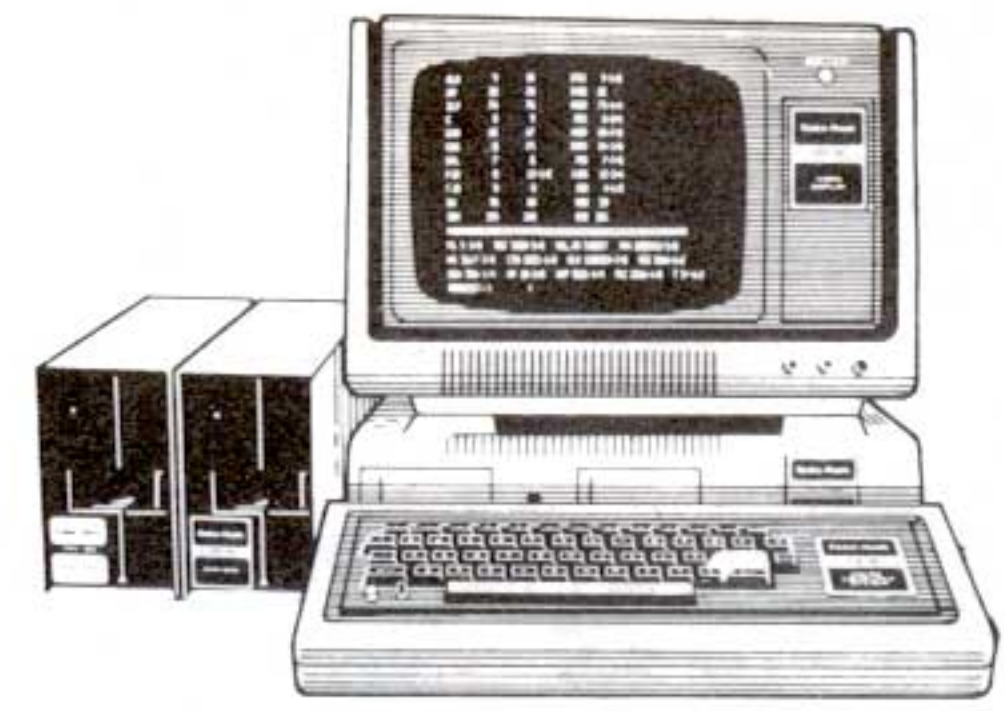
Reversing the Nesting

This final routine reverses the looping, nesting the R loop inside the C loop. Study the progression through the loops, keeping the contents of the counter variables in mind. Or better still, write then in little boxes on a sheet of paper.

```
300 REM (You enter here what this
loop will do)
310 FOR C = 1 TO 5
320   FOR R = 1 TO 3
330     PRINT A(R,C);" ";
340   NEXT R
345 PRINT
350 NEXT C
```

Note that although we've reversed the nesting order, the positions of variables R and C inside the parentheses in line 330 *must* remain R first and C second. This is because we are using the convention of row as the first variable and column as the second.

Many beginning programmers have difficulty understanding nested FOR . . . NEXT loops. It's generally because they don't keep track of what's happening inside the loops. It's easy if you study it. The inside loop executes completely each time the outside loop executes once. Once you understand how this works you'll have no problem with nested loops. That's BASIC.



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Files and foibles

Formatted input routines

Models I/II/III

Terry Dettmann, Associate editor

Do you want to write programs that look good? Is water wet? Those two questions are much alike. They both have obvious answers. Anyone who doesn't want his programs to look good shouldn't be programming computers.

One of the many problems which we wrestle with in making programs look good has to do with getting things in the way we want them. We often want to get some input in a particular format so we can process it easily or force the user to do what we want.

The most common situation I see deals with date and time entry. In most amateur and many professional programs, the way this problem is solved is by using something like this:

```
250 PRINT"ENTER TIME (MM/DD/YY): ";
260 LINE INPUT DT$
```

After this, there might be some complicated checking program to make sure that the month, day and year are acceptable and that there are '/' marks in the right places. That's OK, but it's just not as easy for the programmer as it could be.

Line formatting is something which we do frequently for many different applications. Date is only one of them. The sample program with this article demonstrates a simplified form of a formatted line input routine that will allow you to flexibly enter such things as dates, times, and so forth.

The three important routines start at lines 1000, 1100, and 1200. Subroutine 1000 simply waits for a character from the keyboard and then returns it for use. The special check for CHR\$(19) is for holding the CTRL key and hitting letter 'S'. Then it uses the Model II screen print routine to print a copy of the screen to the printer. You could do something like this with other letters and other commands. Model I/III users should be sure to follow the remarks in the code for altering the program to run on their machines.

The heart of the input procedure is the subroutine at line 1100. The basic procedure comes down to this:

1. Decide on a formatting string (TP\$) and lay it out with the format you want filled.

2. Use the formatting string to display the entry field (line 1110)

3. For each position in the string, if the position is a replaceable character fill it; if it's not, skip it.

Instead of actually replacing the characters in the formatting string, I build a new returning string (IN\$) so that TP\$ would be available for more calls to the subroutine.

The backspacing routine at line 1200 gets more complicated for other than simple entry procedures since it needs to account for the pattern and know what to do if the pattern reaches a character that is not replaceable. The example here will fail if you start the formatting string with a non-replaceable character, but that is easy to fix. Can you do that?

Formatting string entry is a simple, yet necessary procedure for good looking programs. This should give you one more tool in your arsenal.

Program Listing for Files and Foibles

```
10 REM*****
*****
20 REM
30 REM      80 U.S. JOURNAL
40 REM      ENTER DATE/TIME INFORMAT
ION
50 REM
60 REM      VERSION 0.0      03/83
      DATER/BAS
70 REM      (C) 1983 BY TERRY R. DET
TMANN
80 REM
90 REM*****
*****
95 REM      GET SOME SPACE
100 CLEAR10000
105 REM      DEFINE ALL VARIABLES TO
```




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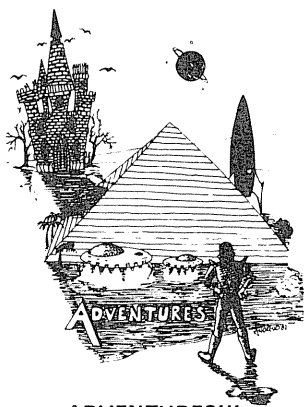
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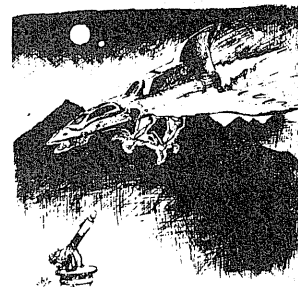
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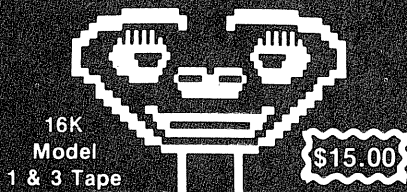
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Files and foibles

BE INTEGER

106 REM (DOESN'T WORK ON COLOR C
OMPUTER)

110 DEFINTA-Z

115 REM DEFINE SOME USEFUL FUNCT
IONS:

116 REM HDR\$ PRINTS HEAD
ER LINES

117 REM CTR\$ CENTERS A S
TRING ON 80 CHR LINE

118 REM FOR MODEL I/III CHANGE 78 TO 62,
77 TO 61, 80 TO 64

120 DEFFNHDR\$(X\$)=STRING\$((78-LEN(X\$))/2
,150)+" "+X\$+" "+STRING\$((77-LEN(X\$))/2,
150)

130 DEFFNCTR\$(X\$)=STRING\$((80-LEN(X\$))/2
, " ")+X\$

200 REM - - - - - MAIN PROGRAM

205 REM PRETTY HEADER (ADJUSTED
FOR MOD II)

210 CLS:PRINTFNHDR\$("80 U.S. JOURNAL"):P
RINTFNCTR\$("DATE/TIME SAMPLER")

215 REM PRINT CHR\$(2) TURNS OFF
CURSOR

216 REM ON MODEL II ONLY - USE C
HR\$(15) ON MODEL I/III

220 PRINT:PRINT CHR\$(2)

225 REM PROMPT FOR DATE ENTRY

230 PRINT"ENTER THE DATE ==> ";

235 REM NOW LAY OUT THE DATE PAT
TERS

236 REM AND CALL THE ENTRY SUBRO
UTINE

237 REM IN\$ COMES BACK WITH THE
PATTERN

238 REM FILLED IN

240 TP\$="##/##/##":GOSUB1100:DT\$=IN\$

245 REM NOW DO THE SAME THING FO
R TIME

250 PRINT:PRINT"ENTER THE TIME ==> ";

255 REM NOTICE THAT I CAN USE AN
Y CHARACTER

256 REM IN THE PATTERN BUT ONLY
'#' WILL

257 REM BE REPLACED

260 TP\$="###:###:###":GOSUB1100:TM\$=IN\$

270 PRINT:PRINT:PRINT

280 PRINTTAB(10)"THE ENTERED DATE AND TI
ME ARE ";DT\$;" ";TM\$

290 END

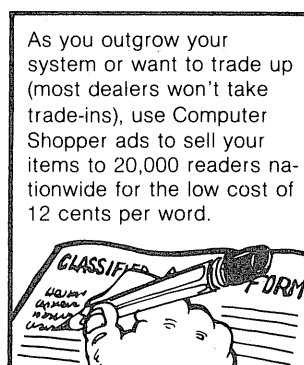
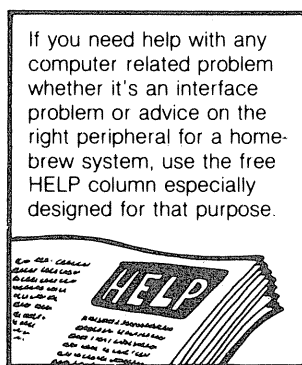
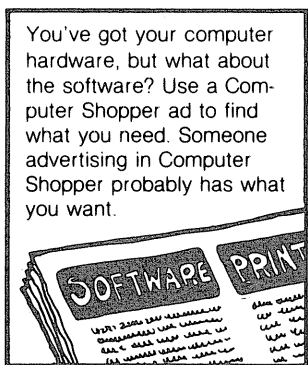
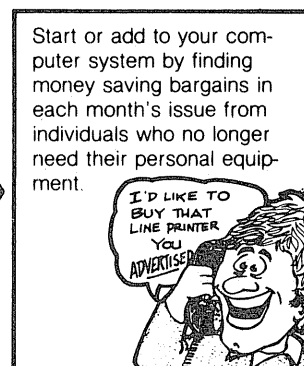
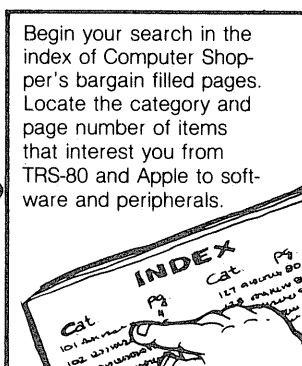
1000 REM - - - - - GET A CHARA
CTER - - - - -

1005 REM WAIT FOR A CHARACTER AT
THE KEYBOARD

1010 C\$=INKEY\$:IF C\$="" THEN 1010

1015 REM MODEL II SCREEN PRINT -

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```

ON MODEL I/III REMOVE LINE 1020
1020 IF C$=CHR$(19) THEN SYSTEM"SCREEN":
GOTO1000
1030 RETURN
1100 REM ----- ENTER A LINE
E -----
1102 REM      HERE WE PRINT THE PATTERN
N (TP$) AND DO A
1103 REM      NON-DESTRUCTIVE BACKSPACE
E OVER THEM
1104 REM      (28 IS THE LEFT ARROW CODE
ON THE MOD II)
1105 REM      PC$ IF THE STRING OF REPLACEABLE
CHARS
1106 REM      ZF IS THE LENGTH OF THE
PATTERN
1107 REM      CC WILL BE THE CURRENT CHARACTER,
IN$ THE RETURNED STRING
1108 REM      KC$ IS THE LIST OF SPECIAL
CHARACTERS (BACKSPACE HERE)
1110 PC$="#":ZF=LEN(TP$):PRINTTP$;STRING$(ZF,28);:CC=1:IN$="":KC$=CHR$(8)
1115 REM      WHAT IS THE CURRENT PATTERN
CHARACTER?
1120 CC$=MID$(TP$,CC,1)
1125 REM      IF IT'S NOT REPLACEABLE,
THEN MOVE IT TO

```

```

1126 REM      THE RETURNED STRING
1130 IF INSTR(PC$,CC$)=0 THEN C$=CC$:GOTO1170
1135 REM      GET A CHARACTER, IF IT'S
A RETURN THEN
1136 REM      WE'RE DONE
1140 GOSUB1000:IF C$=CHR$(13) THEN RETURN
1145 REM      IF IT'S A BACKSPACE, PROCESS IT
1146 REM      WE WRITE THIS AS
AN ON-GOTO
1147 REM      SO YOU COULD HAVE
E MORE SPECIAL
1148 REM      CHARACTERS IN KC$
AND PROCESS
1149 REM      THEM ALL HERE
1150 ON INSTR(KC$,C$) GOTO 1200
1155 REM      IF THE CHARACTER ISN'T PRINTABLE OR
1156 REM      IF WE'VE ALREADY FILLED
THE PATTERN
1157 REM      THEN WE CAN'T ADD IT TO
THE STRING
1160 IF C$<" " OR LEN(IN$)>ZF THEN 1140
1165 REM      WE'VE PASSED ALL THE TESTS, SO WE
1166 REM      ADD THE NEW CHARACTER, PRINT IT,
1167 REM      AND ADVANCE TO THE NEXT
PATTERN
1168 REM      CHARACTER
1170 IN$=IN$+C$:PRINTC$;:CC=CC+1
1175 REM      IF CC>ZF, THAT MEANS THE
PATTERN IS FULL
1180 IF CC>ZF THEN 1140 ELSE 1120
1200 REM..... BACKSPACE ..
.....
1205 REM      IF THERE'S NOTHING INPUT
YET, IGNORE BACKSPACES
1210 IF LEN(IN$)<1 THEN 1140
1215 REM      BACKUP 1 SPACE IN THE PATTERN
1220 CC=CC-1:CC$=MID$(TP$,CC,1)
1225 REM      BACKUP 1 SPACE ON THE SCREEN
1230 PRINTCHR$(28);CC$;CHR$(28);
1235 REM      REMOVE 1 CHARACTER FROM
THE OUTPUT
1236 REM      STRING
1240 IN$=MID$(IN$,1,LEN(IN$)-1)
1245 REM      IF THE CURRENT PATTERN CHARACTER
1246 REM      ISN'T REPLACEABLE, THEN
BACKUP MORE
1250 IF INSTR(PC$,CC$)=0 THEN 1220 ELSE
1140

```

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Reviews

"Understanding Computer Science"

Roger S. Walker

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Understanding Computer Science is a simple introduction to computer science: the science of how to solve problems with the computer. The science has grown rapidly from nothing at all, to an accepted academic study, in just twenty years. This book gives a good, non-technical introduction to a rapidly changing field.

Included chapters discuss topics such as: About computers and computer science, computer architecture and

hardware, how to tell a computer what to do — programming, languages, operating systems — an overview, data structures, language translators, systems analysis, and more. While there is a picture of a TRS-80 Model III in the book, most of the examples of personal systems use the T.I. microcomputer.

The information provided in the book is valuable as background for anyone who wants to seriously use his computer for problem solving. The data structures chapter talks about such things as linked lists, searching, binary trees, and databases. The chapter on languages discusses today's major languages: BASIC, Fortran, Cobol and PL/1.

It is not primarily a book about microcomputers, but it is well written,

comprehensive, and easy enough to read that anyone could gain much from reading it. I liked the book, and so have several others. While the level of detail wasn't enough to go right out and write a disk operating system, or begin to implement a new database, it did answer numerous questions about *why* things are done the way they are.

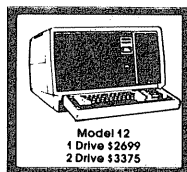
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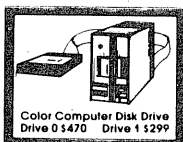
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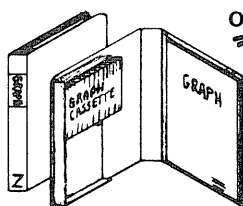
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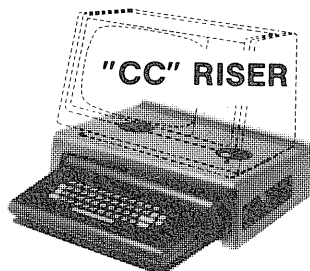
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exclaimed my son when he saw the picture on the instruction sheet for Leaper, "that's the best arcade game there is!"

I hate arcade games. The distributor sent me a copy hoping, I guess, that I'd review it. Here was my chance to write an objective, unbiased review lambasting not only this stupid popular game but also the immature imbeciles who actually buy this trash.

Perhaps I should have suspected something strange when Siegfried, my computer, loaded the tape on the first try — he's never done that before. The clock striking 2 a.m. startled me back to reality. I'd been playing Leaper for five hours — it seemed like twenty minutes. My back and shoulders ached from applying "body english" to get some silly frogs safely past several obstacles . . . I was addicted.

Leaper is a TRS-80 version of the popular arcade game, Frogger. Your goal is to maneuver a leaping frog across a highway with heavy traffic and speeding cars. If you elude the traffic, you must cross a river, jumping from lily pads — which sometimes sink, to logs — which might be crocodiles.

You start with three frogs — and lose one if you don't put it safely into one of six pockets at the top of the screen. When

you have filled all six pockets you progress to a higher skill level — more cars, fewer lily pads and logs. At the fourth skill level (the highest I've reached so far) a snake slithers across what had been a safe strip between highway and river — and a crocodile sometimes replaces a log.

At greater skill levels (the game has ten) the number of logs and lily pads continues to decrease and more crocodiles appear. And a new snake stalks the strip at the bottom. That has to be tough!

This is a fast-paced, machine language game. You move the frogs with the up, down, and side arrows — or a joystick, if you have one. The average journey from start to safety takes less than half of the thirty-second limit. (I suspect that at the greater skill levels I'm approaching, one learns to jump backwards effectively and uses more time.)

What fascinates (and disturbs) me most about Leaper is some things it taught me about myself — things I'm reluctant to admit. Patience and perseverance pay. There's plenty of time to maneuver the frogs to safety. Yet I find that I try to get points faster than necessary — to jump onto a sinking lily pad rather than wait for a stable one or to jump too soon. I find myself ignoring the

conservative qualities of maturity that I try to teach my kids: don't take unnecessary risks — look before you leap.

Is Leaper worth \$15.95? As entertainment — probably. As an inexpensive psychological self-study — definitely.

James A. Conrad

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under TDOS or DOSPLUS; many of its features rely on DOS-specific drivers. We were successful in running the program under NEWDOS/80 Version 2. However, at least one of the built-in features of Microterm did not function properly with it. More about that later.

Upon booting up, the Microterm program is autoloading and the operating logo appears at the top of the screen. This is the normal communications mode. To start communicating, simply dial the phone number, connect the modem, and start typing. The Model III version is guaranteed to talk at 4800 baud with no nulls inserted (nulls are do-nothing characters that slow down the data stream so that the other computer does not drop characters.) Two computers, directly-connected, without a modem, are able to talk at 9600 baud. According to Micro-Systems, Model I's are certified only to 600 baud null-free because of differences in interrupt handling.

The command mode is toggled by hitting the CLEAR key and the main menu appears instantly. The transition is so fast that the program continues to accept input from the RS-232 port without slowing down or missing any characters. When you toggle back to the communications mode, all of the data that was sent during the time in command mode is there. This feat is accomplished by means of an overflow buffer. There is a time limit while in this mode of about 27 seconds at 300 baud (or six seconds at 1200 baud), but it is a really terrific feature!

Twenty commands are available from the main menu. Six commands are for the buffer (a buffer is a data storage area in RAM - about 34K bytes in a 48K machine). The first command toggles the buffer open or closed for manual reception of data. When downloading files, most host bulletin boards send codes to open and close the buffer automatically, but there are times when you need to do it manually. The clear buffer command erases the entire buffer. There are load buffer and save buffer commands that allow data to go to and from the disk. You may also print the contents of the buffer. The transmit command allows you to send the buffer contents to the remote computer. Several options allow prompted send, character delay time, and even an automatic timed-transmit. This last feature allows unattended transmission of the buffer at a preset time, such as when the phone rates are lower.

The next group of commands are used to set various operating parameters. You may set your RS-232's baud rate, word length, number of stop bits, and parity as well as select half or full duplex, video line-width, suppression of linefeeds or

carriage returns, and toggle the line printer on and off. These are standard features on most smart terminal packages. However, the ability to alter any of the parameters while on-line, without missing characters, is unique.

You also have special commands. The first of these defines the ten macrokeys. A macrokey is a user-defined character string of up to 64 characters that may be transmitted automatically upon receipt of an ASCII 05 (ENQUIRE) signal. It may also be sent manually by pressing a function key and any numeral between zero and nine. Macrokey 0 is automatically sent upon receipt of the ENQ signal and functions as an auto-logon message. The ampersand (&) may be used in the definition of a macrokey to link one macrokey to another. Macrokeys eliminate a lot of repetitive key strokes when logging on, off, or sending recurring data.

Autodial modems are fully supported. One command selects the type of modem. Now implemented are the Hayes Smartmodem, Radio Shack Modem II, Lynx, Microconnection, Signalman MK VII and others will be supported as they are developed. Another command allows you to set or change the ten names and phone numbers in the phone number table. A third command allows you to dial any one of the ten numbers that were previously set in the table. After the phone number is selected, the number is automatically dialed and the communications mode is toggled. It is one of the handiest and most versatile auto-dial utilities I have seen.

There are seven additional translation tables, besides the phone table, that can be altered or examined. They are for the keyboard, display, printer, buffer input and output, and RS-232 input and output. These tables allow you to customize your system's hardware to Microterm. For example, the printer table can be altered to use a printer that takes other than ASCII characters, or to filter out control codes that could cause double-width printing or other undesirable results.

Other commands are for exiting to DOS, executing any DOS command (works only with DOSPLUS), and saving and loading Microterm files. These files consist of all of the configuration settings and translation tables so that several files can be saved for different types of bulletin boards. An unlimited number of files can be stored and retrieved at will, subject to disk space. This also helps to make Microterm outstanding. In addition to the command menu, the status of all parameters is displayed while in command mode.

Also, there are two utility programs which are included for no charge. They are XFER/CMD, a direct file transfer

program, and FILECONV/CMD, which is an ASCII to Binary conversion program. These utilities allow the transmission and reception of machine language programs between two computers that have similarly equipped utility programs. Utilities like these are rarely supplied with smart terminal programs, or at best, they are offered as an option for extra cost.

The 140 pages of documentation are excellent, with many clear examples of each feature. I would suggest including a quick-reference card, but it is not critical since its operation is so simple.

There is a problem that needs note. I run a Model I with a home-brew lowercase conversion. Using the TDOS operating system produced no lowercase characters on the screen, even though they were being sent out the RS-232 port. Since the lowercase modification is a non-standard one, it may be that TDOS is incompatible with only my hardware. This limitation was solved by transferring the Microterm files to a NEWDOS/80 disk. All of Microterm's features worked except the DOS commands, but they were compensated for by the miniDOS function that is built-in to NEWDOS/80.

Overall, Microterm rates extremely

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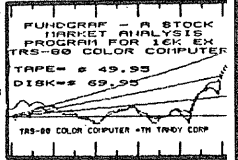
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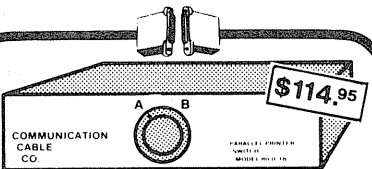
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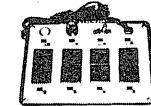
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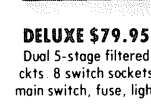


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high with me. Its speed is impressive. The ability to use the command mode while still receiving data is impressive. The auto-dial features are the best I've seen in any program. The ability to alter and save all of the translation tables makes it one of the most versatile terminal programs available. Its extra utilities are really handy for transferring machine language programs. The best part is that the price is right.

Jim Klaproth

CHROMAtrs

Models I/III

\$99 kit, \$169 assembled

South Shore Computer Concepts

1590 Broadway

Hewlett, NY 11557

CHROMAtrs is another attempt to add color to the uncolorful TRS-80 Models I and III. The first such product was the Electric Crayon from Percom, Inc. It sold for \$249.95, a little steep for the added luxury. Well, if you must have color, here is a low-cost alternative to buying a Color Computer (sort of).

The CHROMAtrs does give a Model I or III an added 15-color display, assuming that you have a color TV or monitor attached. In addition, the normal black and white monitor is not disabled, even when the color screen is used. In one of the supplied programs (a lunar lander game), the playing field is presented on the color screen while the altitude and fuel gauge are on the normal monitor. The unit gives high resolution graphics of 192 X 256 pixels, an Atari dual joystick interface, and three dimensional graphic ability.

The unit is available as a kit (no cabinet or AC adapter) or fully assembled in a blue, sheet metal cabinet. It is powered by a plug-in AC adapter similar to the type supplied with tape recorders. A ribbon cable costing \$14 ties your computer to the unit and a video modulator costing \$25, for use with a TV set, are required items. We tested the assembled unit, but the manual contains the kit instructions and we would only recommend this project to an experienced kit builder. There is only one circuit board to assemble, but there are several MOS devices that must be handled correctly to prevent damage. The front of the box contains an LED power indicator, an RCA video jack, and an RCA audio jack for direct connection to a monitor or VCR. On the right side of the unit are the 40-pin and 50-pin edge cards for connecting to the computer. The rear panel has two Atari-type joystick controller jacks and a sub-miniature jack for the AC adapter.

The inside of the unit holds a single circuit board and a video modulator. The

heart of the unit is a Texas Instruments TMS 9918A Video Display Processor (VDP) and 16K of dynamic RAM. The VDP features a unique planar representation for 3D simulations. The video display consists of 35 planes, the first being an external VDP plane, the next is the backdrop, then the pattern plane, and then 32 SPRITE planes. (A SPRITE is a object-oriented 16 X 16 animation pattern that can be moved smoothly across the screen.) These planes are all stacked on top of each other, with the external VDP plane being on the bottom. By skillful programming, you could create 3D images. A separate TMS 9918A manual from Texas Instruments sells for \$5 and is available from South Shore Computer Concepts. It is highly recommended for anyone who wants to go into it in depth. The CHROMAtrs manual does contain enough information to get started.

Software is supplied on either cassette or diskette. Our diskette contained the following files: COLOR/CMD, the main color-driver routine; COLOR/ASM, the EDTASM source code for the driver; SSS, a BASIC lunar lander game; SHOW, a BASIC slide show that displays three different pictures; and LINES, a BASIC random line generator and four picture files to be used by the game and slide show. The menu program was missing from our disk, but it did not cause any inconvenience. The driver program contains several call routines for clear screen, reinitialize the controller, set a point, reset a point, test a point, line draw, string print, game scoring, tone generate, as well as several SPRITE function calls and joystick or paddleread calls. Colors are poked into various addresses according to the function desired. For example, to create a cyan background with a red foreground you would first POKE &HB036, 6(red)*16 + 7(cyan) and call address B009.

The SPRITE pattern is defined as either an 8 X 8 or 16 X 16 square of pixels. The location of a SPRITE is defined by the top left-hand corner of the pattern. The entire pattern can be quickly and smoothly moved, pixel by pixel, by redefining the origin. Each of the 32 SPRITES can be moved independently of the main background picture and each other. This gives you tremendous flexibility in programming; however, it's not a task for the beginner or occasional programmer. Knowledge of machine language and a copy of the TMS reference manual are required for SPRITE programming. The user's manual does not state if SPRITE programming was used to create the pictures supplied on the software, but I suspect it was definitely used for the

lunar lander vehicle. The animation in that game was quite smooth, without the video snow usually associated with TRS-80 animation.

My overall impression of the CHROMAtrs is that it offers the devout hobbyist a new toy at an attractive price. I don't see it becoming popular enough to attract any high-level programmers to write good games for it. It may also have some applications for business graphics or display advertising, but only if there is a competent programmer to write the code. This is a caveat that is true for all add-on peripherals. However, for users who like to roll their own, it offers an incredible price-to-performance ratio, especially if built from a kit.

Jim Klaproth

Mac Inker

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We generate a lot of paper output here. With all the editing, rewriting, listing, and word processing that we do, printer ribbons quickly became a major expense. For a Radio Shack Line Printer VI, the ribbons cost \$11.95 plus tax. And we seemed to use one up every time we just printed out a 10,000 name mailing list. No longer are ribbons a major expense.

The Mac Inker has truly done what the manufacturer promised. It has practically eliminated the cost of replacing ribbons. We can re-ink a ribbon for about a nickel, and it works as good as new. One ribbon has been re-inked at least a dozen times now, and it is still holding up. In a few cases, the re-inked ribbon has given better print than when it was new.

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June, 1983 **103**

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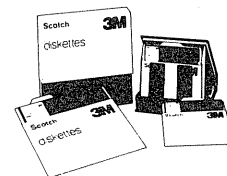
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These notices are free of charge and will be printed one time only on a space available basis. Notices will be accepted from individuals or bona fide computer user clubs only. All announcements must be typed, contain 75 words or less and include complete name and address.

For Sale: Percom Data Separator for the Model I. Check or money order for \$20 will own it. Send to Construction Engineering, Inc., 125 Irving St., P.O. Box 2154, Framingham, MA 01701.

Gifted Student Program: Pacific Lutheran University, Tacoma, WA, is offering an enrichment opportunity for gifted high school students. One of the sessions is a computer games workshop run by Leo Christopherson, author of many well-known and highly entertaining TRS-80 games. The three week, residential experience will help the student learn what is needed to prepare, design, copyright, graphically enhance, and otherwise get a TRS-80 Model I/III or Color Computer game ready to market. During the class, which runs from July 18 to August 5, 1983, the student will attempt to prepare his or her own game for selling. For more information, contact Summer Scholars Program, Office of The Provost, Pacific Lutheran University, Tacoma, WA 98447.

For Sale: Model I/III software. Thirty to seventy percent off, includes documentation. Cassettes and some disks. Includes utilities, games, word processor, and original programs by mathematician and magazine columnist. For free list (no obligation), send a sase to Dr. Michael Ecker, 129 Carol Drive, Clarks Summit, PA 18411. Will also consider trades.

5-pin DIN Plugs for Color Computer hackers. I had quite a difficult time finding the cables and plugs, but when I did, I bought in quantity. 5-pin DIN plugs for \$2.50 each ppd., and five feet of 5-conductor (22GA) stranded cable for \$3.00 ppd. Excess postage refunded on multiple orders. Contact H. M. LaBonville, 121 Camelot RFD 5, Bedford, NH 03102 or call (603) 472-3369.

First triple bulletin board system ever is now being run by Spectrum Projects. Access can be made through (212) 441-3755, 441-3766, or 441-5719. The boards are open 24 hours, every day. Soon to be added is a 20 Meg hard disk, multiplexer and multi-user capability. Bob Rosen is the sysop.

Complete Business System for sale. Best offer taken on TRS-80 Model 16, 8.4 Megabyte hard disk, Line Printer V, cables and more. Radio Shack software includes Time Accounting, Mail List, Accounts Payable, General Ledger, TRS-XENIX, and TRSDOS 4.1 and all manuals. Contact Schweimler, Lowenberg & Lopez, 950 Fawcett Ave. South, Suite 211, Tacoma, WA 98402 or call (206) 572-4114.

User Groups: I am currently working on an article about computer communication and user groups. If you belong to, or know of, a bulletin board service or user group, please send me the name, address, and phone number. It does not have to be an exclusively TRS-80 group. Forward information to Mark Renne, 53 Glacier Court, Bozeman, MT 59715.

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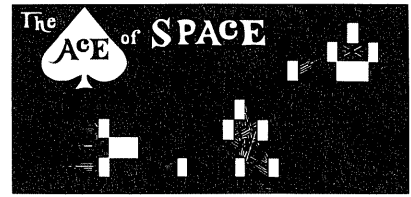
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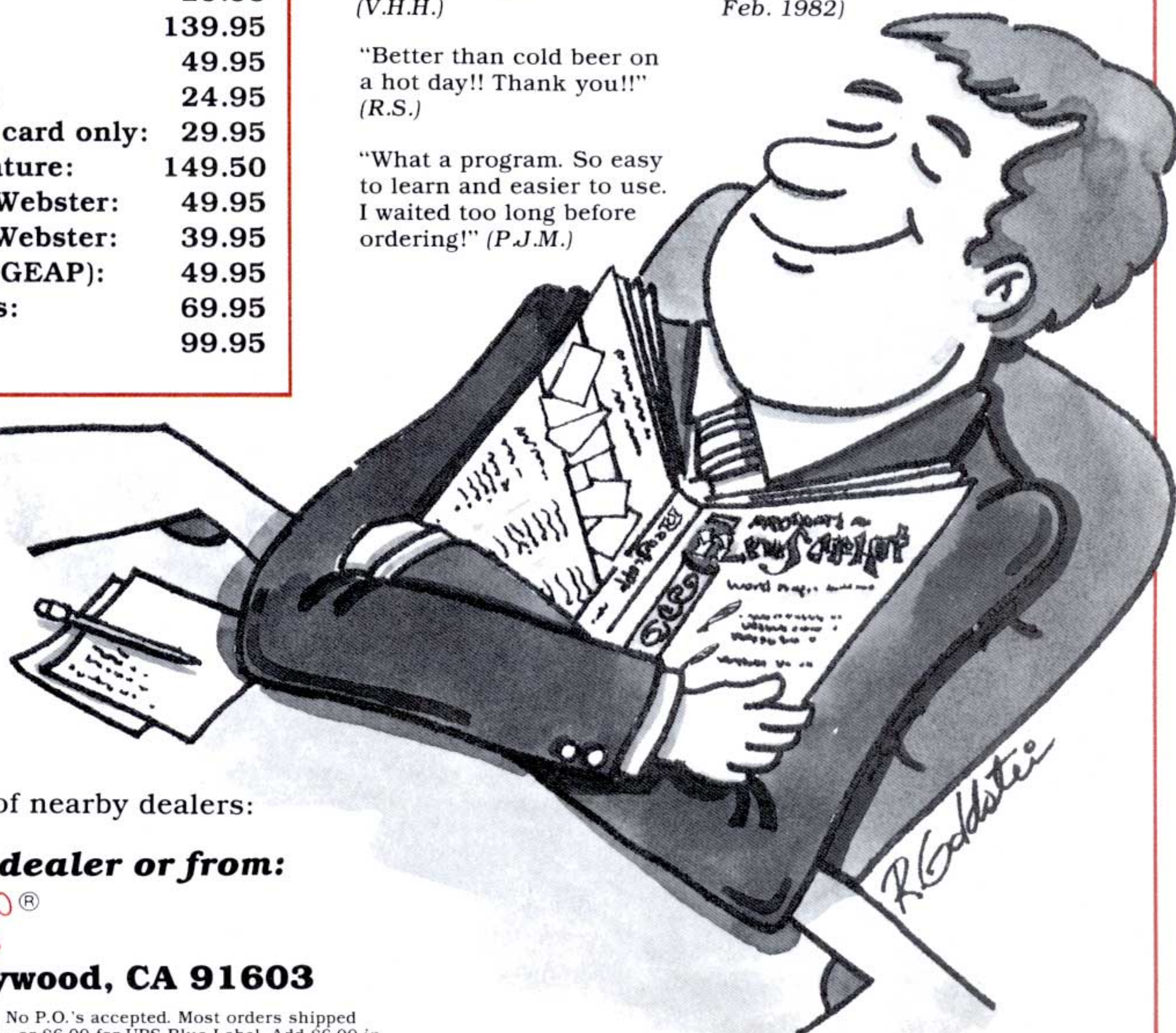
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For the person who just wants to know a bit more than the average user, the book gives a full introductory treatment covering disks, drives, controllers and operating systems.

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Color Computer Genealogy

The twin programs, Family and Famprint, make it possible for you to keep genealogical information on a 32K Extended BASIC Color Computer. The two programs are only \$9.95 postage paid and they will maintain eight generations and 255 ancestors. You can print out a five-generation pedigree chart, family group charts, and a reference number index. Contact The Word Merchant, P.O. Box 232, Lititz, PA 17543 for more information.

Free Software

As part of a special introductory offer to new subscribers, the Business Computer Network is offering a free telecommunications diskette to microcomputer owners.

Valued at \$49.95, the Business Computer Network programming is designed to operate on the TRS-80 series and other major microcomputers such as the IBM, Apple, Osborne, and NEC.

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monthly utility charge for keeping the software up to date.

The telecommunications system diskette is available free by writing or calling the Business Computer Network, 211 South Forth Street, Basin, Wyoming 82410, (307) 568-2413. Offer expires July 1, 1983.

Bigmem for Model I

Bigmem upgrades the Model I TRS-80 or LNW-80 with 64K keyboard RAM. On power-up, 48K of internal memory is available with or without an expansion interface. With one, 32K of external memory can be port-switched to access utilities and data arrays from BASIC, using the USR function, or to extend the size of machine language programs up to 94K. On power-up, all TRS-80 type DOS's function normally.

Memory can be protected for special routines and drivers. Switching to 64K mode either overlays the ROM with RAM, or remaps the video, keyboard, and I/O to high memory for 64K CP/M operation. The choice is determined by a jumper on the internally mounted controller board.

Installation does involve cutting some traces and soldering. The kit includes eight RAM chips, controller board, internal cable/connector, wire, solder, and detailed instruction manual. For price and further information contact Microhatch, P.O. Box 501, DeWitt, NY 13214.

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The cassette, documentation, and a sample program are available for \$29.95 from Classical Computing, Inc., P.O. Box 12247, Lexington, KY 40582.

Antistatic device



SuperScripts Printer Drivers

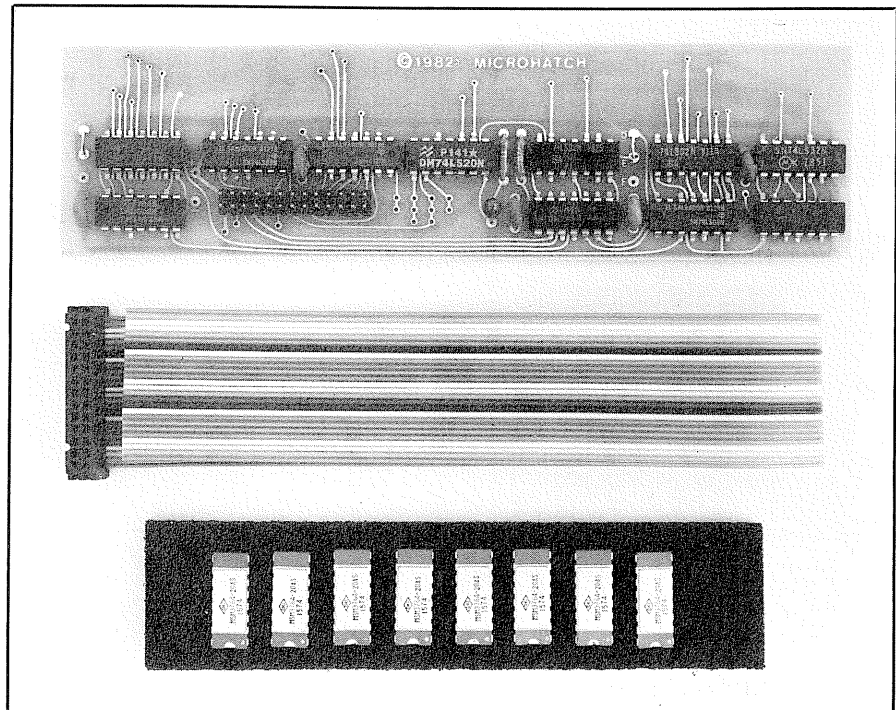
ALPS has added a number of new printer drivers to their product line and now support 23 different printers which allow users to attach their printers to Radio Shack's SuperScripts word processing system. Now supported are the Okidata Microline 92, 93, and 84-Step 2, the Epson FX-80, FX-100, the IDS Prism and Micropism, Qume's Sprint 5, the Brother HR-1 and more. In addition, there is now a generalized serial interface program for the TRS-80 Models I/III which will allow serial printer use with SuperScripts, VisiCalc, BASIC, etc. The serial program is \$39 or \$19 with the purchase of a printer driver. For

Check your I.Q., determine how the men and women in your life rate, check bio-rhythm, make banners, print a Snoopy calendar, draw pictures, nudes and more. This collection promotes interest and reduces computer fear among your staff. All programs are easy to operate, each game is menu driven, and instructions are provided. The set of programs sells for \$49.95 and is available from Eberhard Engineering, P.C., 27 Pine Ridge Drive, Smithtown, NY 11787, (516) 543-7777.

Cassette-based Business Software

Futureview has a complete line of cassette-based business software for the Models I/III or Color Computer. Perform General Ledger (\$49.95), Sales and Inventory (\$49.95), or Checkbook Maintenance (\$24.95) without adding expensive disk drives. All programs perform extensive memory saving and cassette access is kept to a minimum. The manufacturer says that they are very fast and feature a unique sort routine. For further information contact Futureview,

Bigmem for Model I



program called Speak Up! It is a voice synthesizer, is 100 percent software, no hardware, and has a small text-to-speech converter. The program uses just over 7K of memory and can be accessed from

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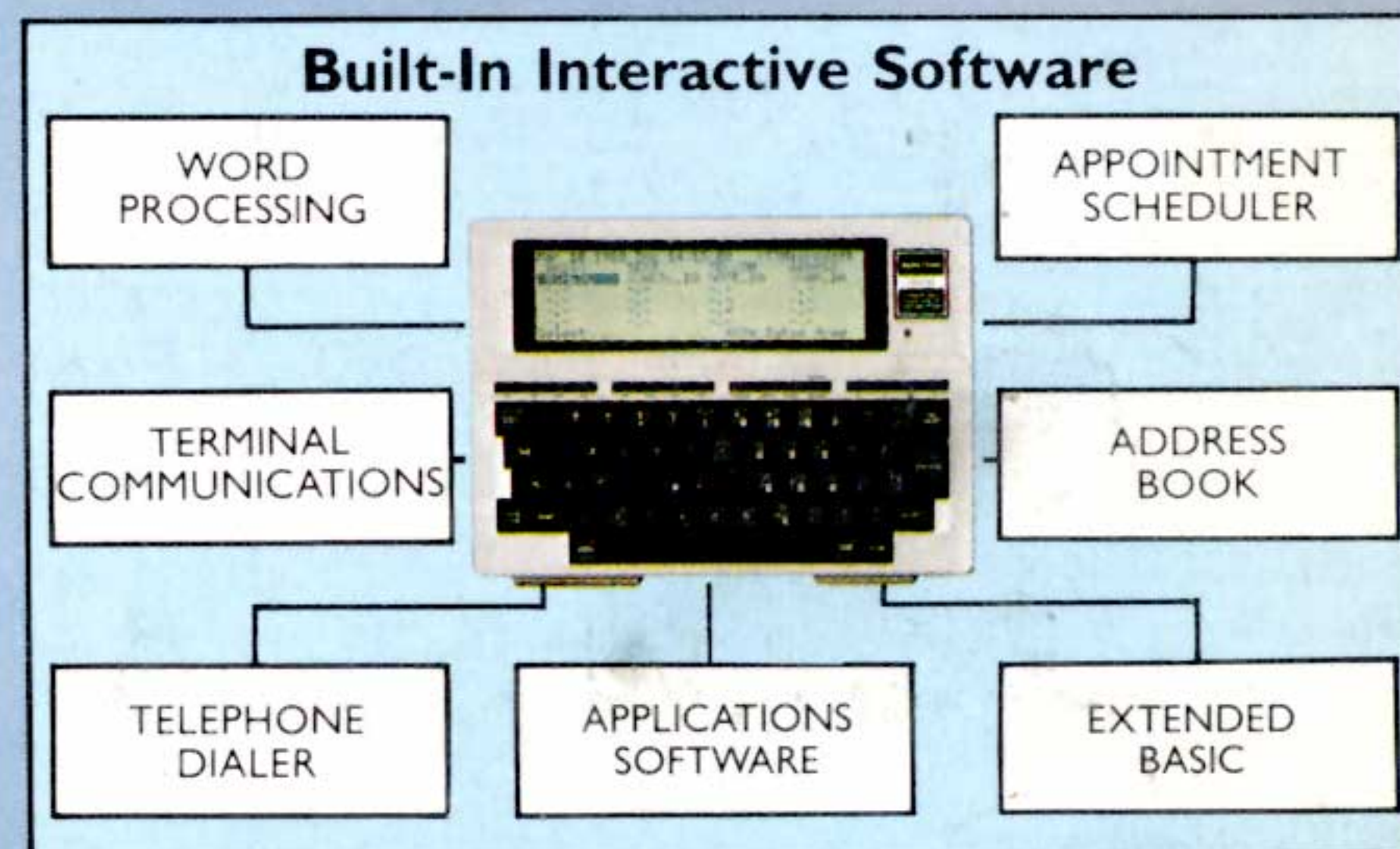
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